11-6625-2684-30

TECHNICAL MANUAL

DIRECT SUPPORT MAINTENANCE MANUAL
TEST SET, LASER INFRARED OBSERVATION DEVICE TS-3620/GVS-5 (NSN 5860-01-052-9477)

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DEPARTMENT OF THE ARMY

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DEPARTMENT OF THE ARMY
WASHINGTON, DC, *1 August 1979*

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TEST SET, LASER INFRARED OBSERVATION
DEVICE TS-3620/GVS-5
(NSN 5860-01-052-9477)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL ME-MQ, Fort Monmouth, NJ 07703.

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		Paragraph	Page
CHAPTER 1.	INTRODUCTION		
Section I.	General	1-1	1-1
II.	Description and Data	1-7	1-3
CHAPTER 2.	FUNCTIONING OF EQUIPMENT		
Section I.	Equipment Interface	2-1	2-1
II.	Analysis of the LR Test Set	2-3	2-1
CHAPTER 3.	DIRECT SUPPORT MAINTENANCE INSTRUCTIONS		
Section I.	General	3-1	3-1
II.	Tools and Test Equipment	3-11	3-12
III.	Troubleshooting	3-12	3-12
IV.	Maintenance Procedures	3-19	3-22
APPENDIX A.	REFERENCES	A-1	A-1
B.	EXPENDABLE SUPPLIES AND MATERIALS LIST		
Section I.	Introduction	B-1	B-1
II.	Expendable Supplies and Materials List		
INDEX			Index-1

LIST OF ILLUSTRATIONS

Figure	Title	Page
1-1	LR Test Set	1-2
2-1	LR Test Set External Parts Location Diagram	2-2
2-2	LR Tester Internal Parts Location Diagram	2-4
2-3	MODE Switch S1 Connections, Simplified Schematic Diagram	2-9
2-4	Transmit/Receive Board Assembly A1A1, Simplified Schematic Diagram	2-10
3-1	Power Supply Board Assembly A3 Layout Diagram	3-2
3-2	Power Supply Board Assembly A3 Voltage Label	3-2
3-3	Oscillator Negative Pulse Display	3-3
3-4	Electronics Board Assembly A2 Layout Diagram	3-4
3-5	Two-Targets, One-Shot Pulse Display	3-5
3-6	Range One-Shot Output Pulse Display	3-6
3-7	Target Sync Pulse Test Setup and Display	3-7
3-8	Test Equipment Setup	3-8
3-9	Receiver Sync Pulse Test Setup and Display	3-9
3-10	Laser Pulse Test Setup and Display	3-10
3-11	MODE Switch S1/Plug W1P1 Wiring Diagram	3-11
3-12	MODE Switch S1 Terminal Location Diagram	3-11
3-13	Adapter Cable Assembly Test Setup	3-16
3-14	Adapter Cable Assembly Schematic and Part Location Diagrams	3-21
3-15	LR Tester Exploded View (Sheets 1 and 2)	3-23 3-24
3-16	Air Pressure Relief Valve and EMI Gasket Location Diagram	3-29
3-17	Optical Shroud and Window Assembly Location Diagram	3-30
3-18	Printed Circuit Board Mounting Bushing Location	3-31
3-19	Alinement Bracket Assembly Exploded View	3-32
3-20	Test Set Identification Plate	3-33
3-21	Adapter Cable Assembly Exploded View	3-34
FO-1	Interface Block Diagram	*
FO-2	Functional Block Diagram	*
FO-3	LR Tester Schematic Diagram	*
FO-4	Power Supply Board Assembly A3 Schematic Diagram	*
FO-5	Electronics Board Assembly A2 Schematic Diagram	*

* Fold-in page, located in the back of the manual.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual contains description and data, functioning of equipment, and direct support maintenance instruction for Test Set, Laser Infrared Observation Device TS-3620/GVS-5 (LR Test Set) (fig. 1-1). The interface between the LR Test Set and the Laser Infrared Observation Device MX-9838/GVS-5(LR) will also be described. Disassembly, replacement, assembly, and testing will be included to restore a faulty test set to proper operation.

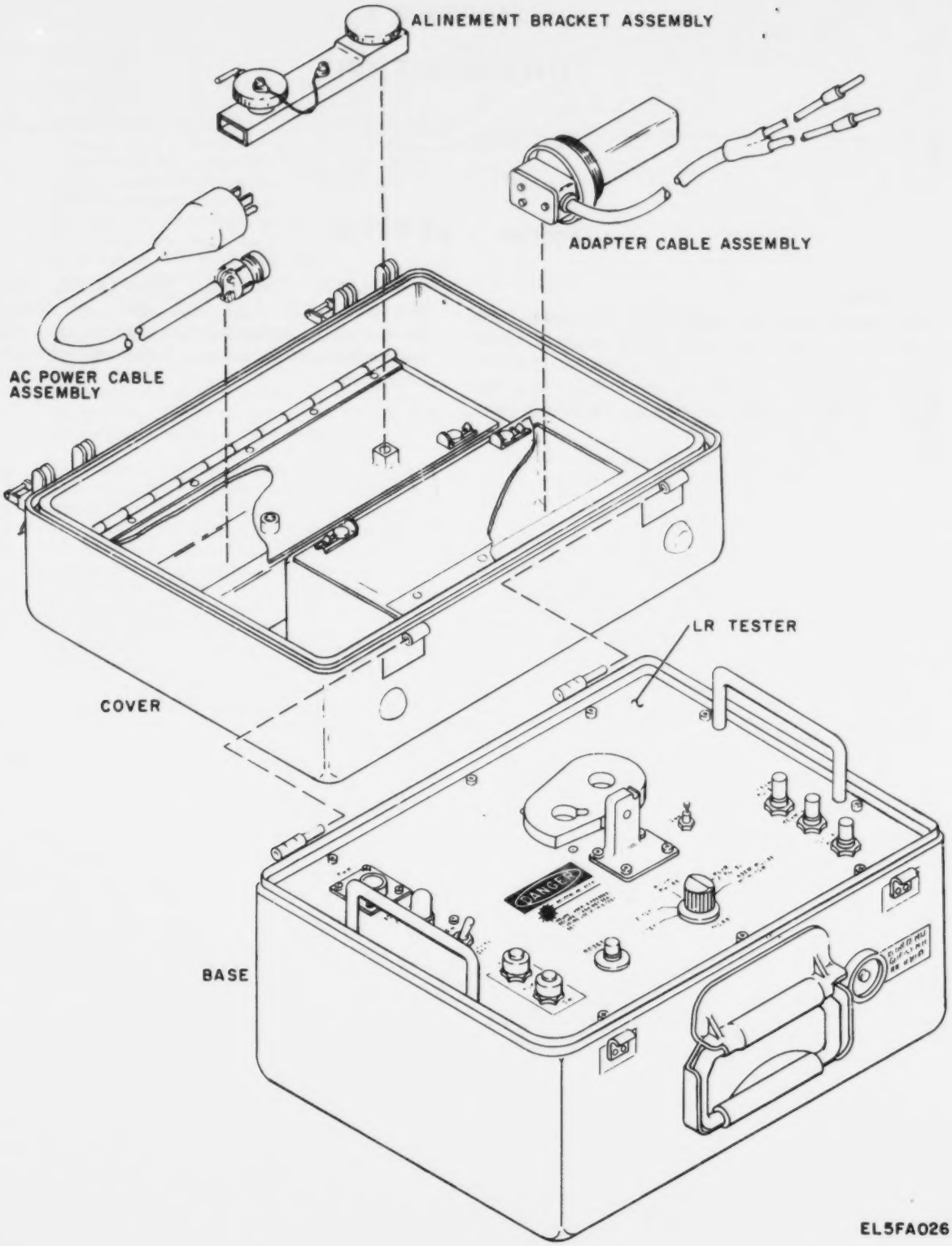


Figure 1-1. LR Test Set

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS AND REPORTS

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, as contained in Maintenance Management Update.

b. Report of Item Packaging Discrepancies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MC04430.3J.

c. Transportation Discrepancy Report (TDR) (SF 361). Fill out and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Instructions for destruction of Army materiel to prevent enemy use are contained in TM 750-244-2.

1-5. CALIBRATION

The LR Test Set will be calibrated when called for on the calibration decal. Calibration is also required when the Xmt/Rcv assembly A1 is replaced or when a test shows that the power supply board assembly A3 readings cannot be adjusted to the values shown on the voltage label.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to: Commander, U.S. Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey, 07703-5000. We'll send you a reply.

Section II. DESCRIPTION AND DATA

1-7. DESCRIPTION

Use TM 11-6625-2684-12, Operator and Organizational Maintenance Manual for Test Set, Laser Infrared Observation Device TS-3620/GVS-5 for the general description and illustrations of the LR Test Set.

1-8. TABULATED DATA

Use TM 11-6625-2684-12, Operator and Organizational Maintenance Manual for Test Set, Laser Infrared Observation Device TS-3620/GVS-5 for the pertinent data for the LR Test Set.

CHAPTER 2
FUNCTIONING OF EQUIPMENT

Section I. EQUIPMENT INTERFACE

2-1 General

The LR Test Set consists of a combination case that houses both the electronic chassis and accessories. The electronic circuits are grouped on printed circuit boards. The boards are mounted on the underside of the front panel (LR Tester) which in turn is installed in the base of the combination case. Accessories are stowed in the removable cover of the combination case. Locations of the accessories are shown in figure 1-1. The purpose of the LR Test Set is to monitor operation of an LR undergoing a test to determine if it is operating within its specified limits. The function of the LR Test Set is to receive optical pulses from the LR under test, generate and return a delayed optical pulse (simulated target return). This chapter describes the functioning of each of the electronic circuits.

2-2. Interface with LR

The interface between the LR Test Set and the LR is mechanical and optical. The electronic functions of both pieces of equipment are the result of an LR projected laser beam and LR Test Set internal stimulus. The LR Test Set provides a Pass/Fail tester. It also acts as an optical signal generator and laser output monitor for LR troubleshooting. The LR Test Set has provisions for mounting the LR with its cover on or off. Use TM 11-5860-201-30, for direct support testing and troubleshooting the LR using the LR Test Set. Refer to TM 11-5860-201-10, for the description of the LR.

Section II. ANALYSIS OF THE LR TEST SET

2-3. General

This section contains the functional description of each of the assemblies and components which make up the LR Test Set. Figures 2-1 and 2-2 show the locations and assigned reference designators. Circuit analysis of the LR Tester is also given in this section.

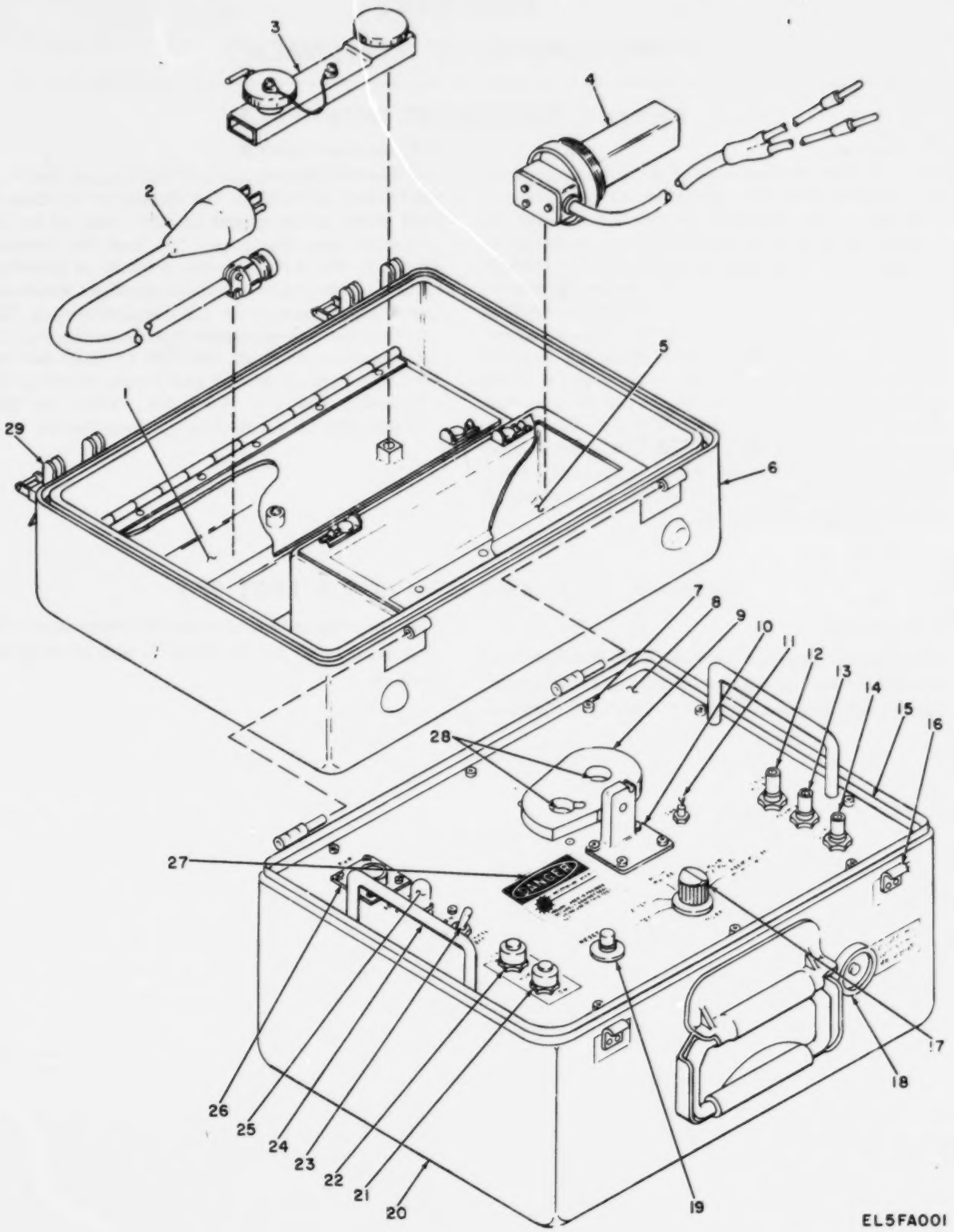
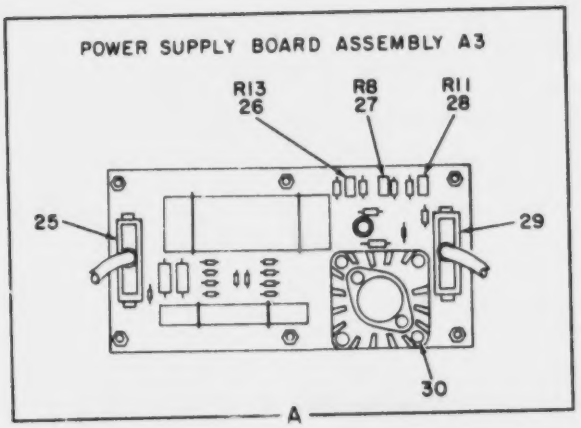


Figure 2-1. LR Test Set External Parts Location Diagram.

1. Storage compartment for ac power cable assembly and alinement bracket assembly with interior rubber cushions
2. AC power cable assembly
3. Alinement bracket assembly
4. Adapter cable assembly
5. Storage compartment for adapter cable assembly with interior cushions
6. Cover
7. Mounting screw (10 each)
8. LR Tester
9. Optical shroud
10. Alinement bracket assembly mount
11. Ground terminal E1
12. LASER PULSE jack J2
13. RCVR SYNC PULSE jack J3
14. TGT SYNC PULSE jack J4
15. EMI gasket
16. Catch (2 each)
17. MODE switch S1
18. Air pressure relief valve
19. RESET switch S2
20. Base
21. LASER OUPTUT LOW indicator DS3
22. LASER OUTPUT NORMAL indicator DS2
23. ON/TRIPPED OFF circuit breaker CB1
24. Handle (2 each)
25. PWR ON indicator DS1
26. PWR jack J1
27. Warning decal
28. Optic windows (2 each)
29. Latch (2 each)

Figure 2-1. LR Test Set External Parts Location Diagram.



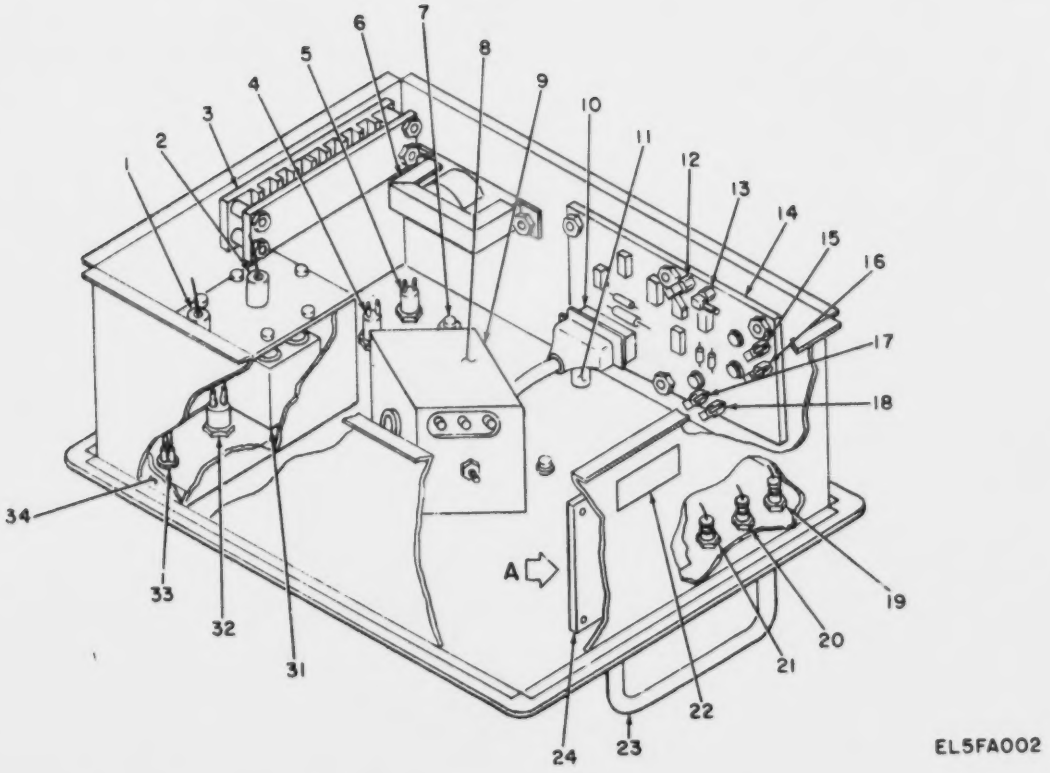


Figure 2-2. LR Tester Internal Parts Location Diagram.

Legend for figure 2-2.

1. Filter FL1
2. Filter FL2
3. Terminal board TB1
4. LASER OUTPUT NORMAL indicator DS2
5. LASER OUPUT LOW indicator DS3
6. Transformer T1 and bracket
7. RESET switch S2
8. Temperature controlled oven (encapsulated within A1 assembly)
9. XMT/RCV assembly A1
10. Connectors W1P1/A2J1
11. MODE switch S1
12. Connectors A2J2/A1P2
13. Connectors A2J3/A1P3
14. Electronics board assembly A2
15. Connectors A2J5/A1P5
16. Connectors A2J4/A1P4
17. Connectors A2J7/W2P7
18. Connectors A2J6/W3P6
19. TGT SYNC PULSE jack J4/Cable W3
20. RCVR SYNC PULSE jack J3/Cable W2
21. LASER PULSE jack J2
22. Power supply board assembly A3 voltage label
23. Handle (2 each)
24. Power supply board assembly A3
25. Connectors W1P2/A3J1
26. Potentiometer R13
27. Potentiometer R8
28. Potentiometer R11
29. Connectors A1P1/A3J2
30. U1 ground lug
31. ON/TRIPPED OFF circuit breaker CB1
32. PWR ON indicator DS1
33. PWR jack J1
34. Filter box

2-4. MODE Switch

(17, fig. 2-1)

NOTE

Optical pulses transmitted by the LR Tester are from a low level light source.

The following modes may be selected at the MODE switch:

a. 1 TGT MODE. In this mode the LR Tester transmits a single optical pulse for each received optical pulse. This mode tests the LR ranging function.

b. 2 TGT MODE. In this mode the LR Tester transmits a pair of optical pulses for each received optical pulse. The transmitted pulses have a predetermined delay and pulse spacing. This mode tests the LR multiple target function.

c. RCVR 1 PULSE MODE. In this mode the LR Tester generates and transmits optical pulses. These pulses are repeated at a rate of 50 pulses per second.

d. RCVR 2 PULSE MODE. In this mode the LR Tester generates and transmits two optical pulses separated by 0.33 microsecond. The pulses are repeated at a rate of 50 pulses per second.

e. LASER PULSE MONITOR MODE. In this mode the LR Tester allows the transmitted LR optical pulse to be monitored as an aid in troubleshooting the LR.

2-5. Function Indicators and Jacks

(fig. 2-1)

In addition to the mode selection other functions are provided as follows:

a. LASER OUTPUT Indicators. Two laser output indicators are provided. The LOW OUTPUT indicator (21) is a red light that turns on whenever the received optical energy exceeds 6.0 millijoules and the NORMAL OUTPUT indicator (22) light is off. The NORMAL OUTPUT indicator is a green light which turns on whenever the received optical energy is above 9.0 millijoules. If neither light comes on, received optical energy is less than 5.0 millijoules. Each light remains on until reset by pressing the RESET switch (19).

b. Pulse Jacks

(1) Two synchronization pulses are used to help troubleshoot the LR. A TGT SYNC pulse is generated prior to each transmitted optical pulse or pulse pair in all operating modes. A RCVR SYNC pulse is generated for each received LR optical pulse. Both synchronizing pulses are available on the front panel jacks (13 and 14) and will drive a terminated 50 ohms coaxial cable.

(2) The LASER PULSE jack (12) is the receiving PIN diode output monitor. This jack is used during LR transmitter test.

2-6. Circuit Functions

(FO-1 and FO-2)

The interface block diagram and the functional block diagram show the operational relationship of the assemblies and components. The function of these assemblies and the overall concept are described in the following paragraphs.

2-7. Power Supply Board Assembly (A3) Function

The power supply board assembly accepts inputs of 115 vac and 12.6 vac. It generates outputs of +100 v and +5.0 v. It contains two threshold adjustments which provide tow adjustable voltages between +1.0 v and +3.0 v. It also contains an adjustment to provide an output voltage between +66 v and +100 v.

2-8. Transmit/Receive Assembly A1 Function

The Xmt/Rcv A1 assembly is made up of an optics housing assembly, an oven assembly, and a Xmt/Rcv board assembly A1A1.

a. Xmt/Rcv Board Assembly A1A1. The Xmt/Rcv board assembly consists of two separately functioning circuits. The transmitter circuit accepts an

input pulse and emits an optical pulse for each input pulse. The receiver circuit accepts an input optical pulse and generates one or two output pulses depending on the received optical energy level.

b. Optics Housing Assembly. The optics assembly above the receiver circuitry includes two diffusers and an aperture. They attenuate the output pulse energy of the LR to a level acceptable to the LR Tester receiver. The optics assembly above the transmitter consists of a lens which collimates the transmitted optical energy from the LR Tester transmitter to the LR.

c. Oven. The oven keeps the operating temperature of tthe Xmt/Rcv board at 140° F (60° C).

2-9. Electonics Board Assembly A2 Function

The electonics board assembly under the control of the MODE switch generates either one or two output pulses upon receiving stimulus to the input. In addition, synchronizing pulses are generated which coincide with both the stimulus and the output pulses. When selected by the MODE switch, an internal oscillator generates a continuous train of output and synchronizing pulses.

2-10. MODE Switch S1 Function
(FO-1)

The MODE switch function is to control the signals to and from the electronics board assembly A2. The function for each mode is described in paragraph 2-4.

2-11. RESET Switch S2 Function
(FO-1)

The RESET switch resets the flip-flop circuits in the electronics board assembly. These in turn control the LASER OUTPUT indicator circuits DS2 (NORMAL) and DS3 (LOW).

2-12. LASER OUTPUT Indicators DS2, DS3 Function
(FO-1)

The indicators NORMAL AND LOW tell the operator if the normal or low power threshold has been crossed by the LR output. The NORMAL and LOW indicators are also press-to-test devices.

2-13. Monitor Jacks J2, J3, J4 Function
(FO-1)

The function of the jacks is to have pulse monitoring points for external test equipment. These are as follows:

a. LASER PULSE jack J2.
b. RCVR SYNC PULSE jack J3.
c. TGT SYNC PULSE jack J4.

2-14. Adapter Cable Assembly (ACA) Function
(FO-1)

The ACA functions as a power input and an electromagnetic interference (EMI) blocking device. The ACA connects dc power to the LR while testing.

2-15. Operational Process
(FO-2)

The LR Tester Operational process is described in the following paragraphs.

a. Optical Energy Measurement. Optical energy from the LR is diffused and attenuated in the receiving optics which are located in the Xmt/Rcv assembly. The diffusion provides a uniform spatial distribution to minimize the LR alinement sensitivity. The aperture reduces the LR output to a safe level for the PIN diode detector. The PIN diode detects the received optical pulse. It converts the optical power to an electrical charge which is stored in a capacitor. Output voltage from the capacitor, which is proportional to optical energy, is compared with two reference voltages. One comparison is made in a low power comparator. The other comparison is made in a normal power comparator. If the capacitor voltage exceeds the low power threshold, the comparator output drives the power monitor logic and turns on the LASER OUTPUT LOW indicator DS3. Also, the low power threshold output drives a pulse stretcher U5B. In turn, it starts the range timer U4B and generates a sync pulse at the RCVR SYNC PULSE jack J3. If the capacitor voltage exceeds the normal power threshold voltage, the normal power threshold output drives the power monitor logic to turn off the LASER OUTPUT LOW indicator DS3 and turn on the LASER OUTPUT NORMAL indicator DS2.

b. Target Simulation and Timing. The range timer, after timing out, triggers the multiple targets timer U5A. When the MODE switch is set to 2 TGT or RCVR 2 PULSE, the range timer triggers the 2-targets pulse generator U1A. The output of the multiple targets timer is a pulse, 0.67 ±0.33 microsecond wide, which drives the 1-target driver Q1 and target synchronizer line driver Q3. The target synchronizer connects to the TGT SYNC PULSE jack J4 on the front panel where it is available to troubleshoot the LR. The 1-target line is connected to the light emitting diode (LED) driver circuit in the Xmt/Rcv assembly A1. This circuit discharges a capacitor C1 timed by the leading edge of the pulse, through a LED CR3 to generate an output optical pulse 10 ±5 nanoseconds wide at 1,064

nanometers. The output of the LED is diffused and partially collimated in the transmitting optics. Diffusion and collimation illuminate the receiving optics in the LR with a uniform light energy without requiring a critical optical alinement between the LR and the LR Tester. In the 2-TGT and RCVR 2 PULSE modes, two pulses are required with a spacing of 0.67 ±0.33 microsecond (100 ±50 meters). The second pulse is generated by using the trailing edge of the multiple targets output to trigger the 2-targets pulse generator. The multiple targets timer pulse width is the required 0.67 ±0.33 microsecond.

c. Two-Targets Generation. The output of the 2-targets pulse generator drives transistor Q2 which, in turn, drives a second LED driver CR4 circuit in the Xmt/Rcv assembly A1. This LED driver discharges a second capacitor C2, through the LED CR3, to produce an optical pulse with the same characteristics as the first, but delayed by a time equivalent to a target separation range of approximately 100 meters. In the RCVR 1 PULSE and RCVR 2 PULSE mode, a 50 Hz oscillator U4A is turned on by removal of a short circuit across an integrator. This oscillator triggers the range timer U4B every 20 milliseconds. Remaining operations are identical to those previously discussed except that no RCVR SYNC pulse is generated and no indicator light is turned on.

2-16. Power Input Circuit Operation (FO-3)

The LR Tester operates from a 115 vac electrical power source. Prime power is applied through jack J1 and primary power circuit breaker CB1 to line filters FL1 and FL2. The prime power available at TB1 is then applied across the primary of T1 and to the Xmt/Rcv assembly A1. Two secondary windings of T1 supply the necessary voltages for the power supply board assembly A3.

2-17. Power Supply Board Assembly A3 Operation (FO-4)

The power supply board assembly A3 has two separate power supplies. One is for the receiver and one is for the transmitter.

a. Receiver Power Supply. The receiver power supply bridge rectifies the 12.6 vac from transformer T1. Through series regulator U1, it provides regulated +5 v. This regulated +5 v is applied across two voltage dividers which allow for fine adjustment of receiver sensitivity. The low power threshold is adjusted by potentiometer R8. The normal power threshold is adjusted by potentiometer R11.

b. Transmitter Power Supply. The transmitter power supply bridge rectifies the 115 vac. Through series regulator Q1, it provides regulated +100 v. This is the source for the voltage divider, potentiometer R13 and resistor R14. It allows the output voltage to be set between +66 and +100 v thus giving a fine adjustment for transmitter power output.

2-18. Electronics Board Assembly A2 Operation (FO-5)

The electronics board assembly interfaces with the Xmt/Rcv board assembly. It consists mainly of microcircuits and transistors.

a. Operation. Microcircuits U4A and U4B form a dual timer circuit. The 50 Hz oscillator U4A is used when the test set is in the receiver test mode. It generates pulses at a rate of 50 Hz. The frequency is determined by the values of potentiometer R4 and capacitor C4. Capacitor C4 becomes charged to a fixed potential then discharges through part of U4A. The resulting output pulse is coupled to the range timer U4B through diode CR1. The range timer U4B is triggered every 20 milliseconds. It produces an output pulse width corresponding to a range delay of 4,800 ±200 meters. The output pulse from U4B is coupled directly to the multiple target timer U5A. When the MODE switch is set to RCVR 1 PULSE, the U4B output is applied to U1A. The multiple target timer U5A is actually triggered by the trailing edge of the U4B output pulse. The result is that the output pulse from U5A follows the input trigger to U4B by 32 ±1.34 microseconds (4,800 ±200 meters). The output pulse from U5A-4 drives transistors Q1 and Q3. Output pulses from Q1 are applied to CR1 in the Xmt/Rcv assembly through J4. The output from Q3 is applied to J6 on the control panel. A tap at the common point of C4 and of U4A-1 is connected to terminal S1A-1 of the MODE switch. This shorts C4 to ground through the MODE switch and shuts off the 50 Hz oscillator when the test set is not in the RCVR 1 or RCVR 2 modes.

b. Optical Pulse Power Control. When U5A-4 is emitting pulses it is emitting pulses of the opposite polarity at U5A-13. When a delayed pulse simulating a second target is required for testing, this output is applied through the MODE switch to U1A-1. The 2-targets pulse generator U1A is triggered by the trailing edge of the 0.68 microsecond pulse causing its output pulse to be delayed by that amount. The output pulse from U1A-4 is applied to Q2 then through J5 to the Xmt/Rcv assembly. When the MODE switch is set to RCVR 1 PULSE, both the 1 TGT and 2 TGT outputs are driven high at the same time. This provides

a single optical pulse with about twice the power. It is used as an aid in receiver troubleshooting for marginal receiver sensitivity. The U1A gets its input pulse directly from U4B–9 and not from the delayed output of U5A–13.

c. NORMAL Lamp Control. Microcircuits U2, U3, Q5, and Q6 operate the LASER OUTPUT LOW and NORMAL indicators. The latch U2A and B is one flip-flop and U2C and D is the second flip-flop. When the RESET S2 switch is closed, capacitor C5 is discharged through R2 to ground. This resets both U2 flip-flops.

d. LOW Lamp Control. When an optical pulse is received, the Xmt/Rcv board assembly generates a negative going pulse that is applied to the input at U2C–9 and the input at U5B–9 through J3. This grounds both inputs, and triggers U5B causing it to emit a one microsecond pulse. This pulse is applied to U4B–8 through CR2 and U4B generates the range delay. The one microsecond pulse at U5B–12 is also applied through Q4 to J7. This is the receiver synchronizing pulse. When the pulse is applied to set U2C and U2D, it causes U3A–2 to go high which causes U3B–6 to be high. This action causes Q6 to conduct and draw current through DS3 (LOW indicator) causing it to come on. A normal power pulse from the Xmt/Rcv assembly is applied to U2B–5 through J2 to set flip-flop U2A and U2B. This causes U3C–9 and U3A–1 to go low. Microcircuit U3A–3 goes high causing U3B–6 to go low and shut off Q6 thereby causing DS3 to go out. At the same time U3C–8 goes high to turn on Q5 and causes DS2 (NORMAL indicator) to come on.

e. Test Points. Three test points are provided in the electronics board assembly circuits. Test point TP1 is a monitor point for the output pulse from U4B. Test point TP2 is located between CR1 and CR2 to measure the input pulse to U4B. The third test point, TP3, is at the two-target pulse output from U1A.

2–19. Mode Switch S1 Operation (fig. 2–3)

The MODE switch S1 is a three-wafer, five-position switch that makes or breaks connections to components on the electronics board. Only the A and B wafers are used. The C wafer is unused. The wiper of wafer A is connected directly to ground. The wiper of wafer B is connected to U1A–1. When the MODE switch is in position 1, C4 is shorted to ground through the wiper of wafer A. At the same time the input to U1A is grounded through wafer B. Thus, there is no output from either U4A or U1A with the switch in this position. When the MODE switch is moved to position 2, C4 is still short-circuited through the wiper of wafer A. There is still no output from U4A. The output from U5A–13 is connected through wafer B to U1A–1. An output from U1A is applied to Q2 to supply the 2 TGT PULSE output. If the MODE switch is in position 3, C5 is shorted to ground through wafer A to preclude setting flip-flop circuits U2A through U2D. This condition prevents the NORMAL and the LOW indicator lamps coming on. Pressing and releasing the RESET switch S2 provides the same result on a momentary basis. The output from U4B–9 is applied directly to U5A–1 and to U1A–1, through wafer B. When the MODE switch is in position 4, C5 is shorted to ground through wafer A as it was in position 3. An output from U5A–13 is applied to the U1A–1 through wafer B. Position 5 of the MODE switch short circuits C4 to ground through wafer A to disable U4A. The U1A–1 is grounded through wafer B so that there is no output from U1A.

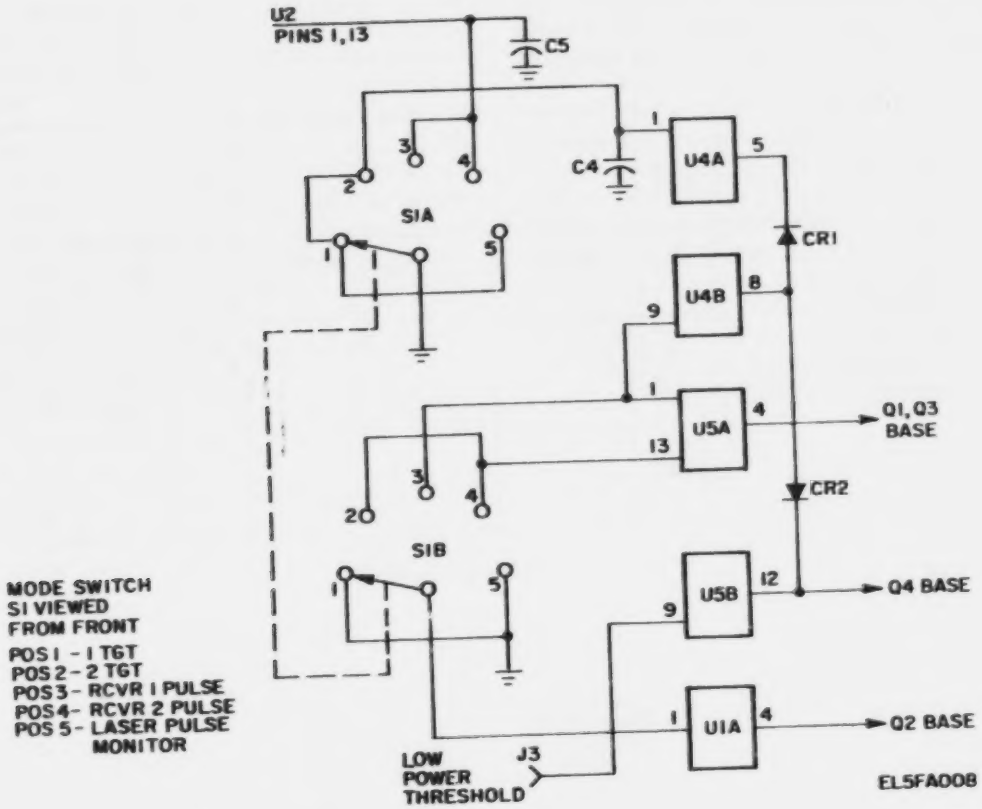


Figure 2-3. MODE Switch S1 Connections, Simplified Schematic Diagram.

2-20. Transmit/Receive Board Assembly A1A1 Operation (fig. 2-4)

The Xmt/Rcv board assembly A1A1 contains two separate circuits. One circuit contains the transmitter diode CR3 with associated circuitry. The other circuit contains the receiver diode CR5 with associated circuitry.

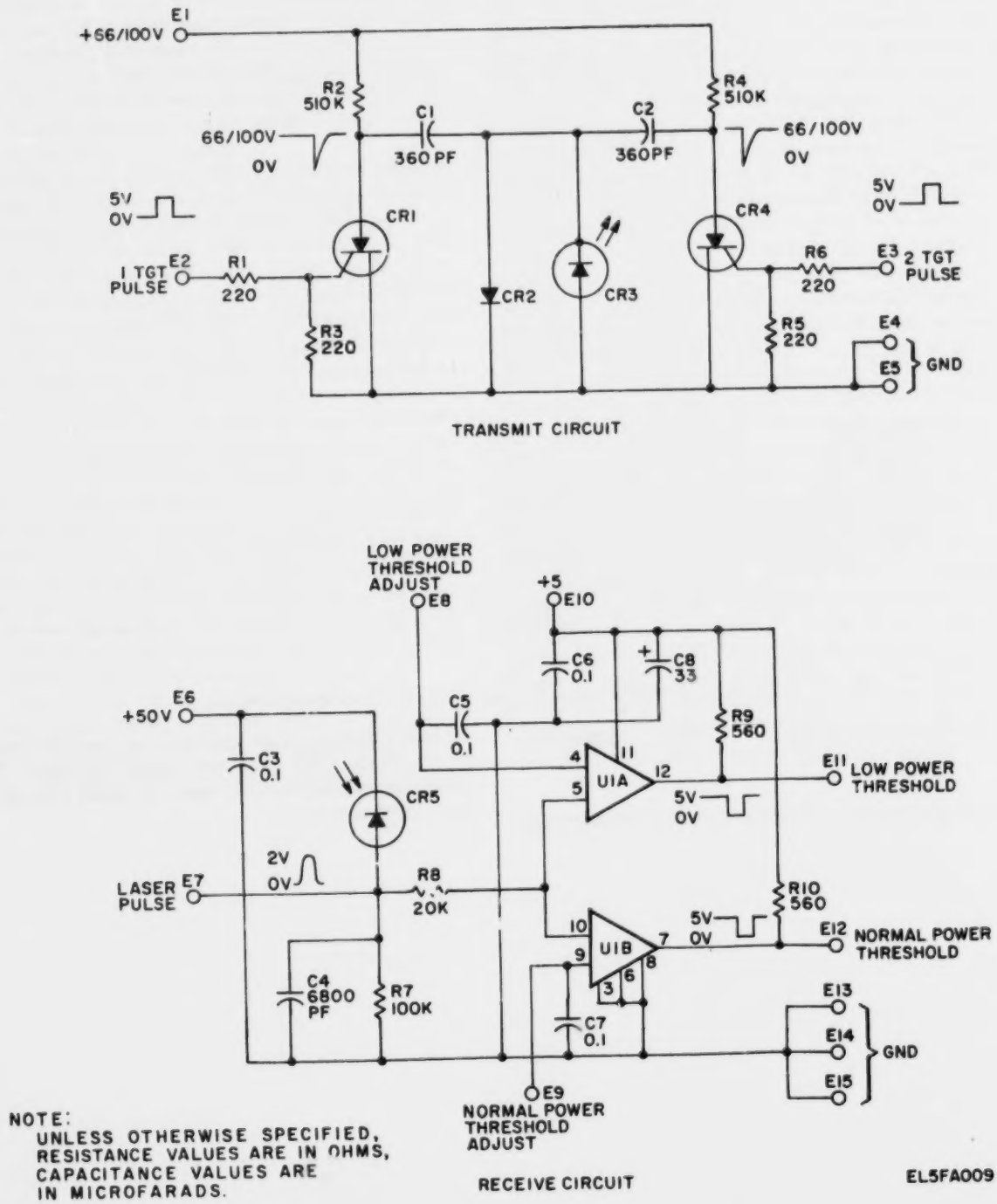


Figure 2-4. Transmit/Receive Board Assembly A1A1, Simplified Schematic Diagram.

a. Transmit Circuit. The drive for CR3 comes from the discharge of C1 or C2, 360 picofarads capacitors, charged to a value between 66 to 100 volts. Capacitor C1 is discharged by triggering on CR1, a silicon controlled rectifier (SCR). This device, when triggered, has a very fast turn-on and a very low resistance resulting in an output optical pulse in the order of 10 nanoseconds width. Diode CR1 is turned off by using a very large resistor R2 in series with the supply voltage. This reduces the anode current below the holding level. The 1-target diode CR1 and 2-targets diode CR4 drivers are identical. Diode CR2 provides a charge path for C1 and C2. Diodes CR1 and CR4 were selected for 120 v operation. The gate-to-source resistance is low to prevent false triggering of CR1 or CR4.

b. Receive Circuit. The receiver circuits on the Xmt/Rcv board assembly consists of a PIN diode CR5 driving two high speed comparators U1A and U1B. Light energy striking the CR5 charges C4. The voltage on C4 is proportional to the received energy. The reference voltages are set by potentiometers on the power supply board assembly for easy access. The reference voltages are adjustable between 1.0 and 3.0 v. Each reference voltage is stabilized at the comparator inputs by C5 and C7. Resistors R9 and R10 pull up the output of U1A and U1B to +5.0 v when U1A and U1B are off. The electronics board flip-flop U2 is triggered by the negative going edge at the output of U1A and U1B. Terminal E7 provides an output through a 50 ohms impedance coaxial cable to the front panel for monitoring the voltage across C4. When this cable is terminated in 50 ohms impedance, the voltage across C4 is proportional to received LR output pulse power.

CHAPTER 3

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

3-1. Introduction

(fig. 2-1)

This chapter gives instructions for troubleshooting, disassembly, replacement, adjustment, and assembly needed to repair the LR Test Set. Figures and diagrams needed to support the instruction are also given. Repair personnel will inspect the LR Test Set to determine if any fault or malfunction can be found and fixed before the final test. Troubles which can be corrected include those cases covered in TM 11-6625-2684-12. In those cases where fixing the trouble is beyond the scope of Direct Support Maintenance, send the LR Test Set to the Depot. In such a case, the LR Test Set must be fully reassembled and complete. To get to the parts inside the LR Tester, remove the cover, the ten mounting screws (7) and lift the LR Tester out of the base.

3-2. Voltage and Resistance Measurements

The measurements in the following paragraphs are the circuit performance standards that repair personnel will use when testing and troubleshooting. The test conditions under which the measurements are to be obtained are also given.

3-3. Power Supply Board Assembly A3 Voltage Measurements

(figs. 3-1 and 3-2)

WARNING

High voltage may be present on exposed terminals. Use care when measuring.

a. Measurements. The measurements for the power supply board assembly A3 are shown in table 3-1. The test points to measure are shown in figure 3-1. The voltage levels must match those shown on the power supply board assembly A3 voltage label (fig. 3-2).

b. Test Setup. (fig. 3-1).

(1) Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF.

(2) Remove the ac power cable assembly (2) from the PWR jack (26).

(3) Take the LR tester out of the base (para 3-1).

(4) Remove W1P1 from A2J1 (10, fig. 2-2).

(5) Remove A1P1 from A3J2 (29).

(6) Put the ac power cable assembly on the PWR jack.

(7) Set the ON/TRIPPED OFF circuit breaker to ON.

(8) Measure the voltages using a digital voltmeter.

(9) When the measuring is done, set the circuit breaker to TRIPPED OFF and reconnect A1P1 to A3J2 and W1P1 to A2J1.

Table 3-1. Power Supply Board Voltage Measurements

Ground Point	Control	Test Point	Requirement
U1 ground lug or E6	R8	TP1	Adjustable between +1.0 and +3.0 V
U1 ground lug or E6	R11	TP2	Adjustable between +1.0 and +3.0 V
U1 ground lug or E6	None	TP3	Between +4.7 and +5.3 V
U1 ground lug or E6	None	TP4	Between +90.0 and +115.0 V
U1 ground lug or E6	R13	TP5	Adjustable between +60.0 and +115.0 V

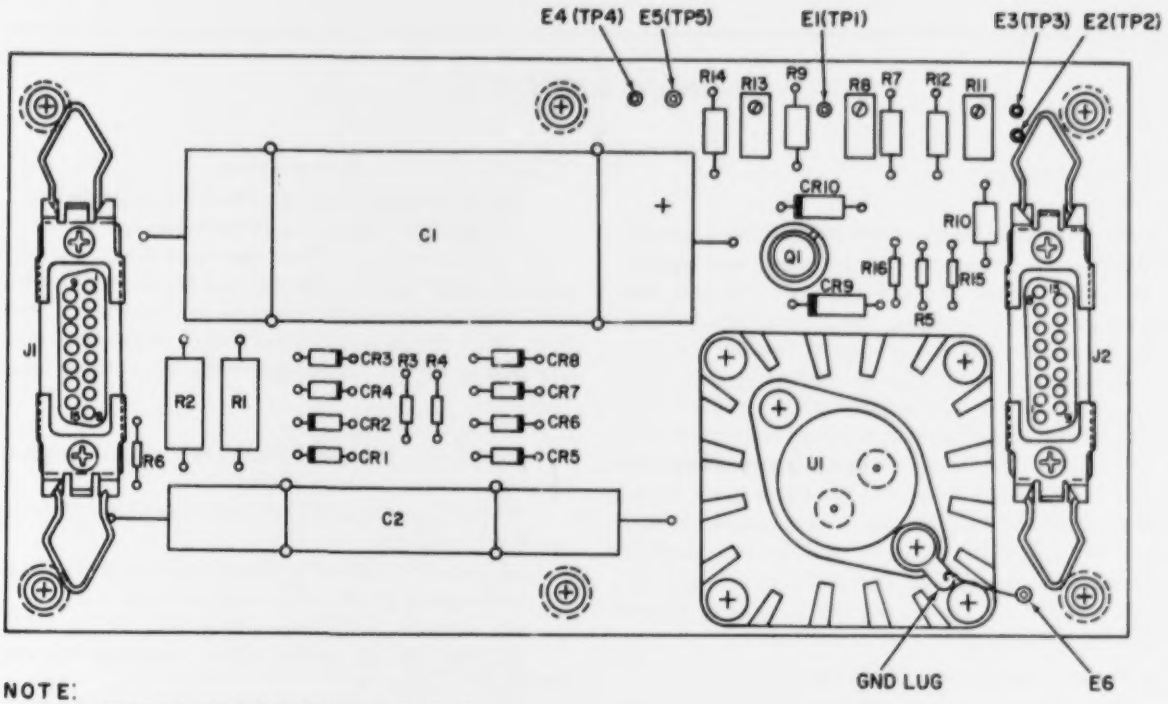


Figure 3-1. Power Supply Board Assembly A3 Layout Diagram.

LOW PWR THRESHOLD
VOLTAGE (A3TP1) _____ VDC

NORM PWR THRESHOLD
VOLTAGE (A3TP2) _____ VDC

66/100 VDC (A3TP5) _____ VDC

DATE _____

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Figure 3-2. Power Supply Board Assembly A3 Voltage Label.

3-4. Electronics Board Assembly A2 Oscillator Negative Pulse Check
(figs. 3-3 and 3-4)

a. Measurements. The measurements and display for the electronic board assembly are shown in figure 3-3. The test setup is shown in figure 3-4.

b. Test Setup.

(1) Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF.

(2) Remove the ac power cable assembly (2) from the PWR jack (26).

(3) Take the LR Tester out of the base (para 3-1).

(4) Put the ac power cable assembly on the PWR jack.

(5) Set the circuit breaker to ON.

(6) Connect oscilloscope ground lead to the ground terminal (11).

(7) Connect a probe to the channel A input connector on the scope.

(8) Set the MODE switch (17) to RCVR 1 PULSE.

(9) Touch the channel A probe to test point TP2 (fig. 3-4).

(10) The waveform should be as shown in figure 3-3.

(11) Set the circuit breaker to TRIPPED OFF. Remove the probes from the test point and the ground terminal.

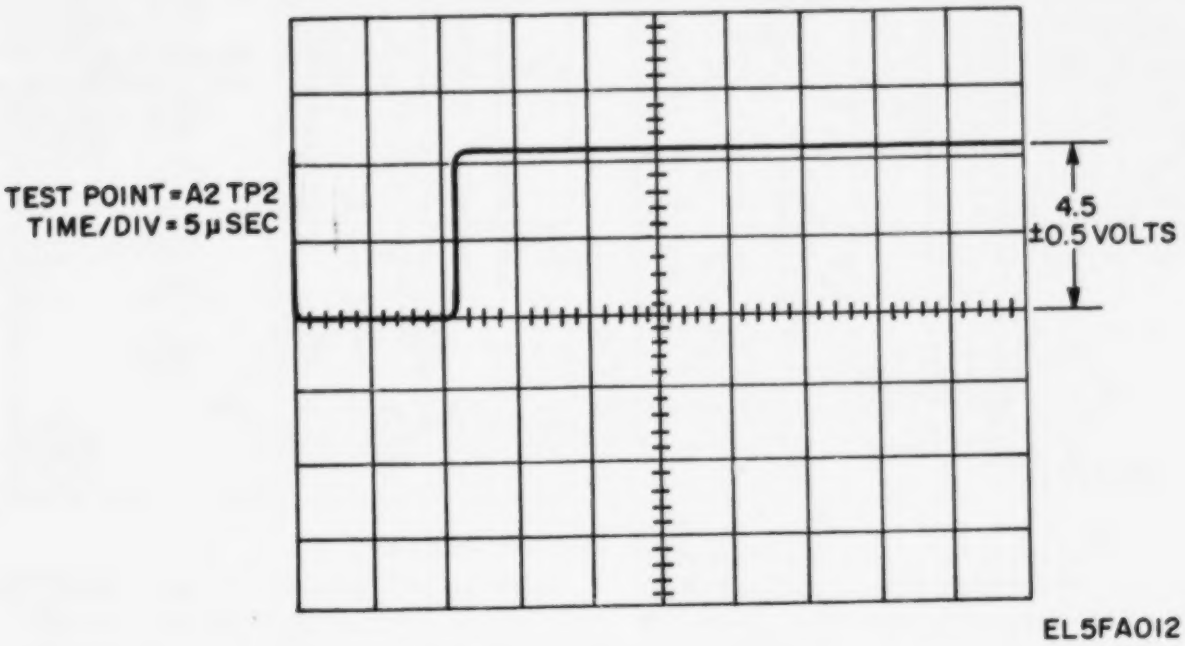
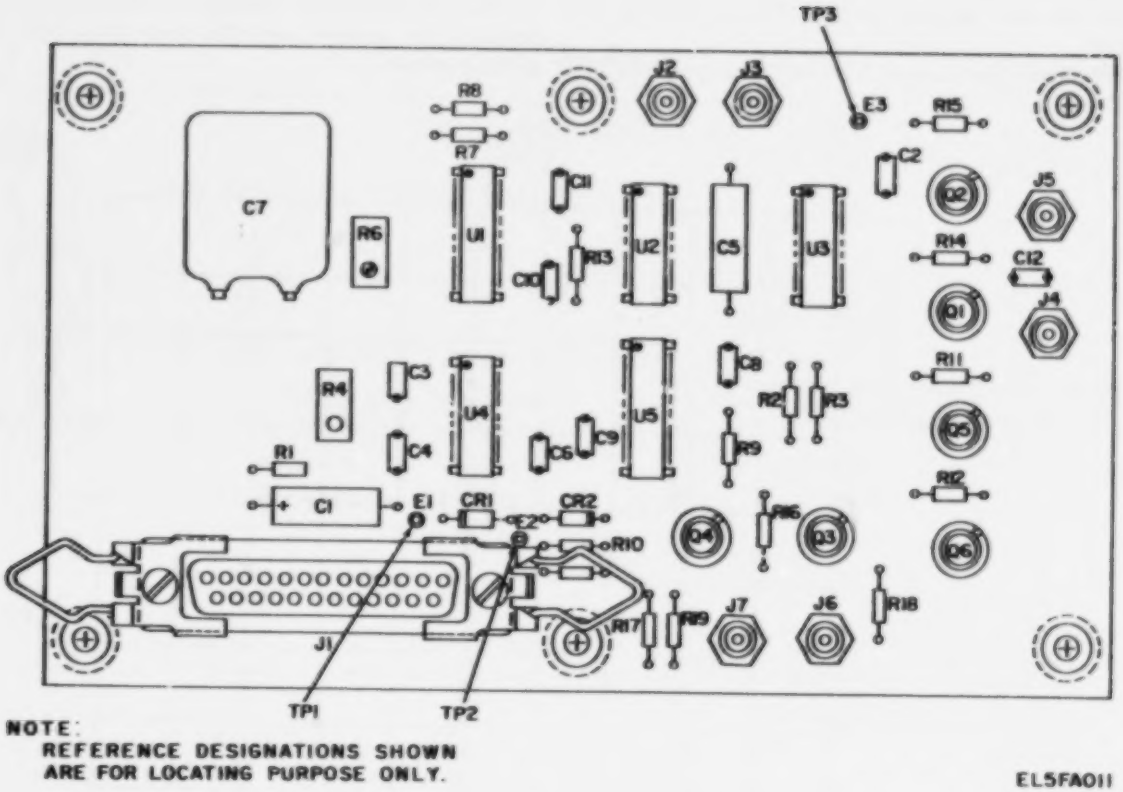


Figure 3-3. Oscillator Negative Pulse Display.



NOTE:
REFERENCE DESIGNATIONS SHOWN ARE FOR LOCATING PURPOSE ONLY.

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Figure 3-4. Electronics Board Assembly A2 Layout Diagram.

3-5. Electronics Board Assembly A2 Two-Targets, One-Shot Pulse Check
(figs. 3-4 and 3-5)

a. Measurements. The measurements and display for the electronic board assembly are shown in figure 3-5. The test points are shown in figure 3-4.

b. Test Setup.

(1) Set the ON TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF.

(2) Remove the ac power cable assembly (2) from the PWR jack (26).

(3) Take the LR Tester out of the base (para 3-1).

(4) Put the ac power cable assembly on the PWR jack.

(5) Set the circuit breaker to ON.

(6) Connect the oscilloscope ground lead to the ground terminal (11).

(7) Connect a probe to the channel A input connector on the scope.

(8) Set the MODE switch (17) to RCVR 1 PULSE.

(9) Touch the channel A probe to test point TP3 (fig. 3-4).

(10) The waveform should be as shown in figure 3-5.

(11) Set the circuit breaker to TRIPPED OFF. Remove the probes from the test point and the ground terminal.

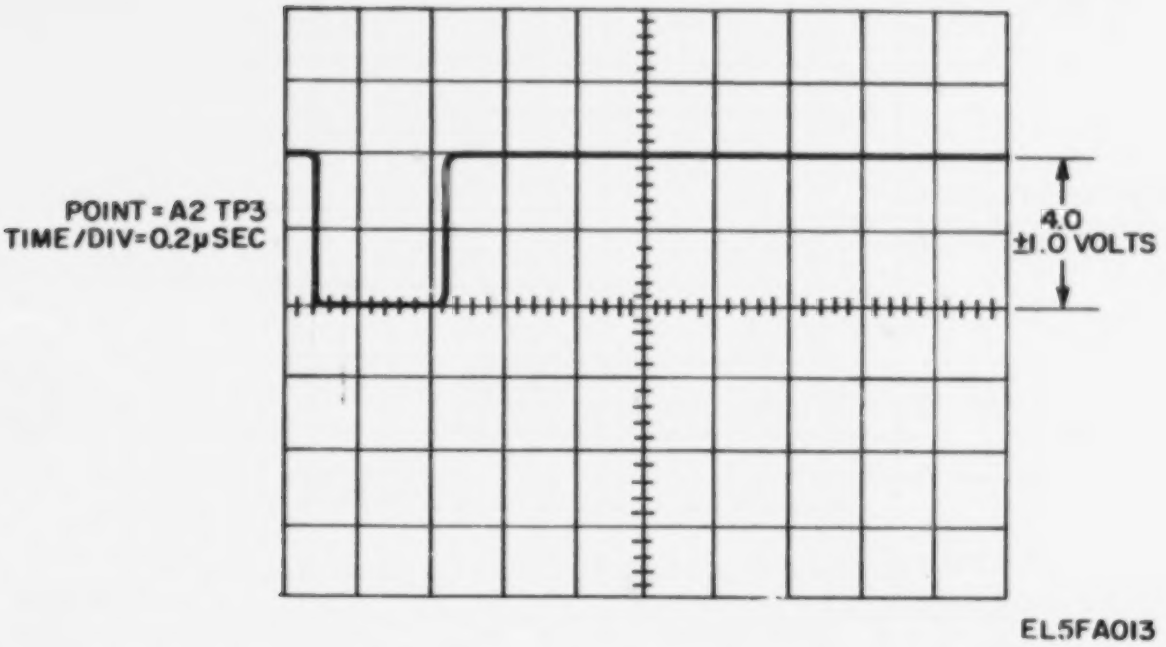


Figure 3-5. Two-Targets, One-Shot Pulse Display.

3-6. Electronics Board Assembly A2 Range One-Shot Output Pulse Check
(figs. 3-4 and 3-6)

a. Measurements. The measurements and display for the electronic board assembly are shown in figure 3-6. The test points are shown in figure 3-4.

b. Test Setup.

(1) Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF.

(2) Disconnect the ac power cable assembly (2) from the PWR jack (26).

(3) Take the LR Tester out of the base (para 3-1).

(4) Connect the ac power cable assembly on the PWR jack.

(5) Set the circuit breaker to ON.

(6) Connect oscilloscope ground lead to the ground termminal (11).

(7) Connect a probe to the channel A input connector on the oscilloscope.

(8) Set the MODE switch (17) to RCVR 1 PULSE.

(9) Touch the channel A probe to test point TP1 (fig. 3-4).

(10) The waveform should be as shown in figure 3-6.

(11) Set the circuit breaker to TRIPPED OFF. Remove the probe from the test point and the ground terminal.

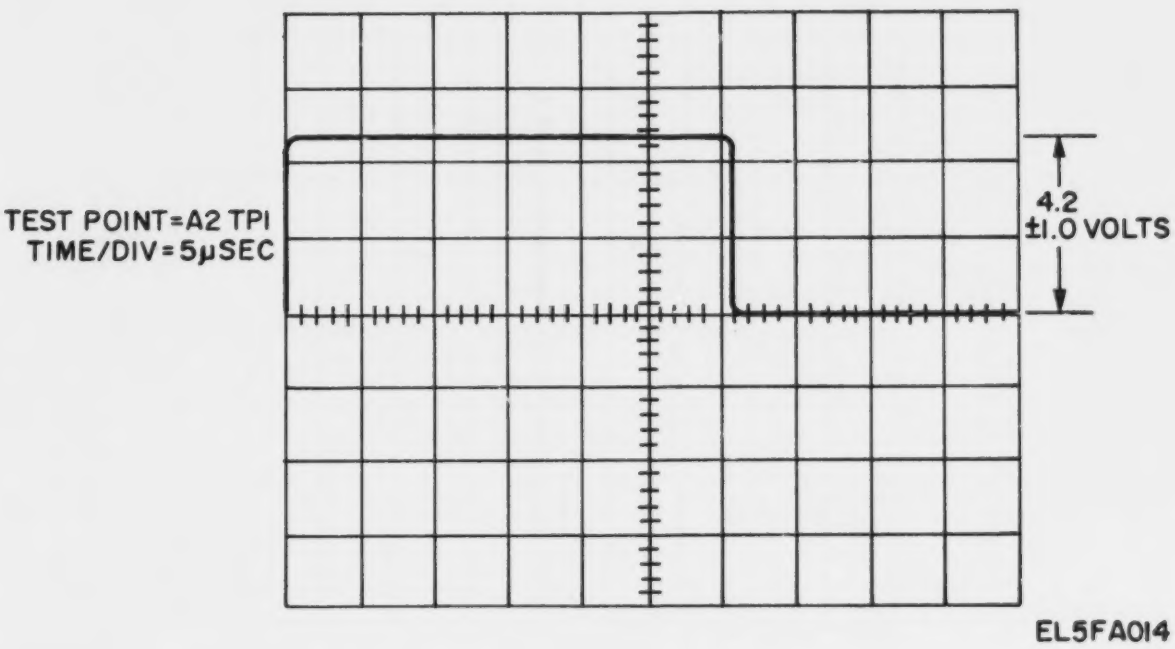


Figure 3-6. Range One-Shot Pulse Display.

3-7. LR Test Set Target Sync Pulse Display Check (figs. 3-7 and 3-8)

a. Measurements. The measurements and display for LR Test Set target sync are shown in figure 3-7. The test setup is shown in figure 3-8.

b. Test Setup.

(1) Arrange the test setup as shown in figure 3-8.

(2) Set the MODE switch (17, fig. 2-1) to 1 TGT PULSE.

(3) Make the electrical connections shown in figure 3-7.

(4) The waveform shown in figure 3-7 appears momentarily when the LR is fired.

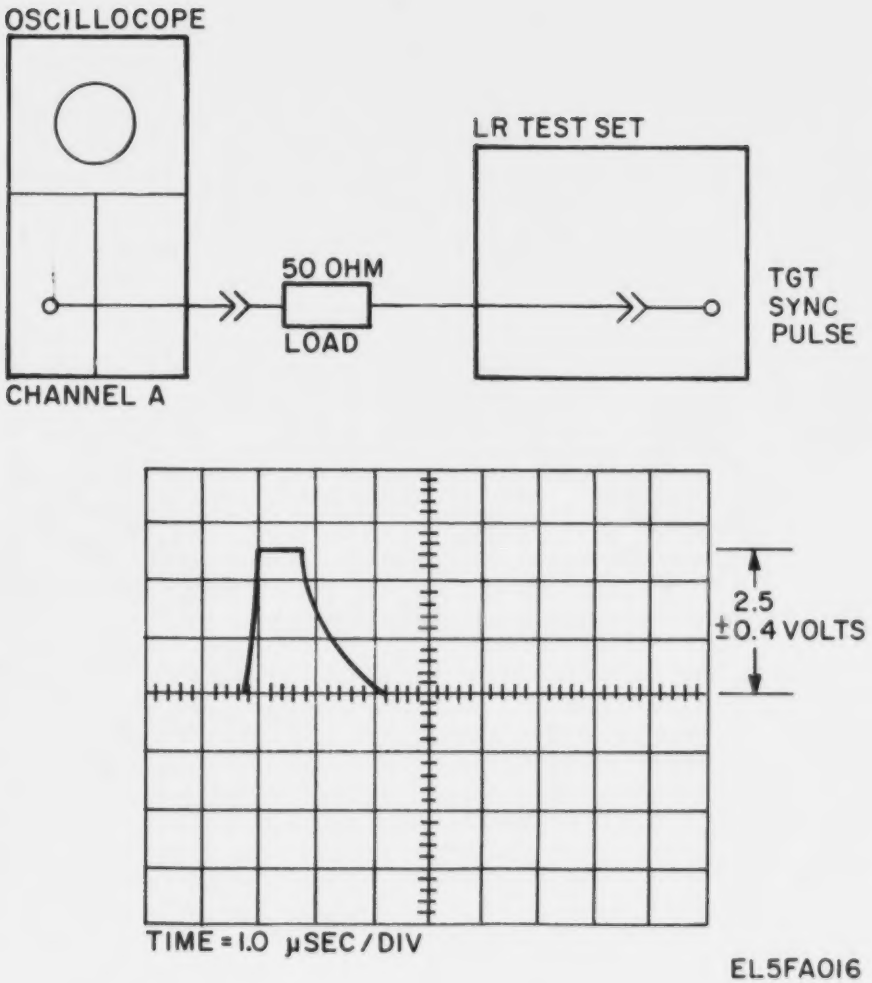


Figure 3-7. Target Sync Pulse Setup and Display.

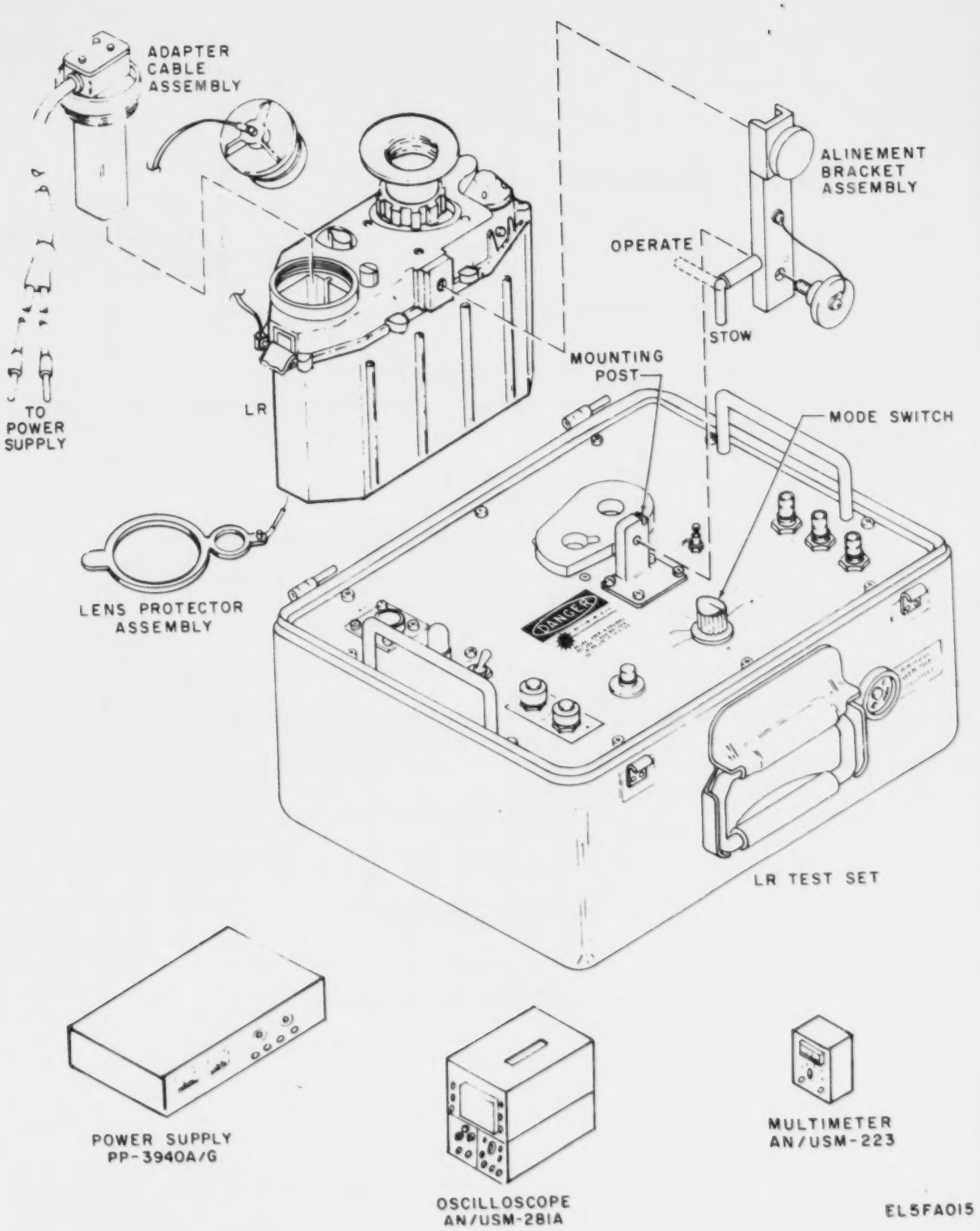


Figure 3-8. Test Equipment Setup.

3-8. LR Test Set Receiver Sync Pulse Display Check
(figs. 3-8 and 3-9)

a. Measurements. The measurements and display for the LR Test Set Receiver sync are shown in figure 3-9. The test setup is shown in figure 3-8.

b. Test Setup.

(1) Arrange the test setup as shown in figure 3-8.

(2) Set the MODE switch (17, fig. 2-1) to 1 TGT.

(3) Make the electrical connections shown in figure 3-9.

(4) The waveform shown in figure 3-9 appears momentarily when the LR is fired.

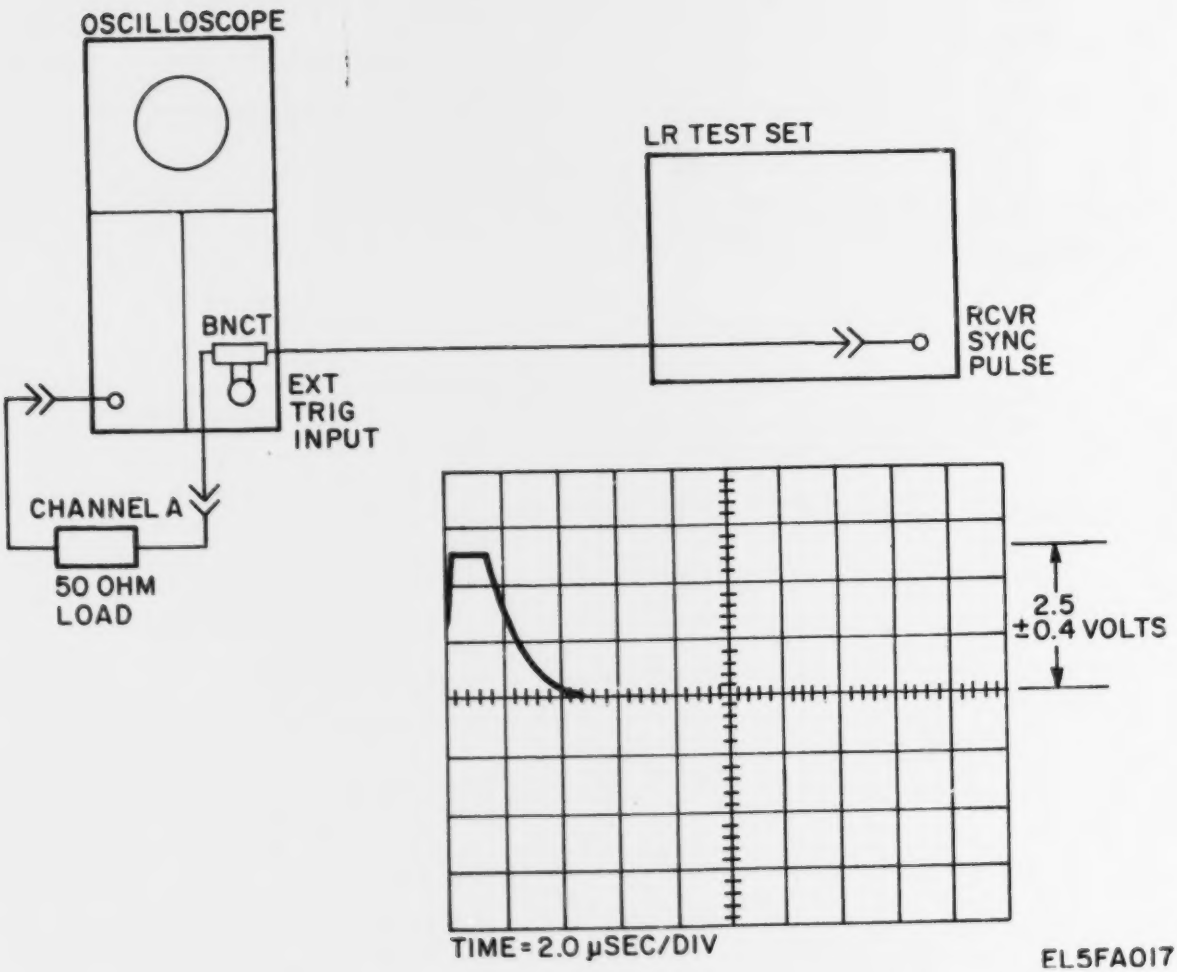


Figure 3-9. Receiver Sync Pulse Test Setup and Display.

3-9. LR Test Set Laser Pulse Display Check (fig. 3-8 and 3-10)

a. Measurements. The measurements and display for the LR Test Set Laser Pulse are shown in figure 3-10. The test setup is shown in figure 3-8.

b. Test Setup.

(1) Arrange the test setup as shown in figure 3-8.

(2) Set the MODE switch (17, fig. 2-1) to LASER PULSE MONITOR.

(3) Make the electrical connection shown in figure 3-10.

(4) The waveform shown in figure 3-10 appears momentarily when the LR is fired.

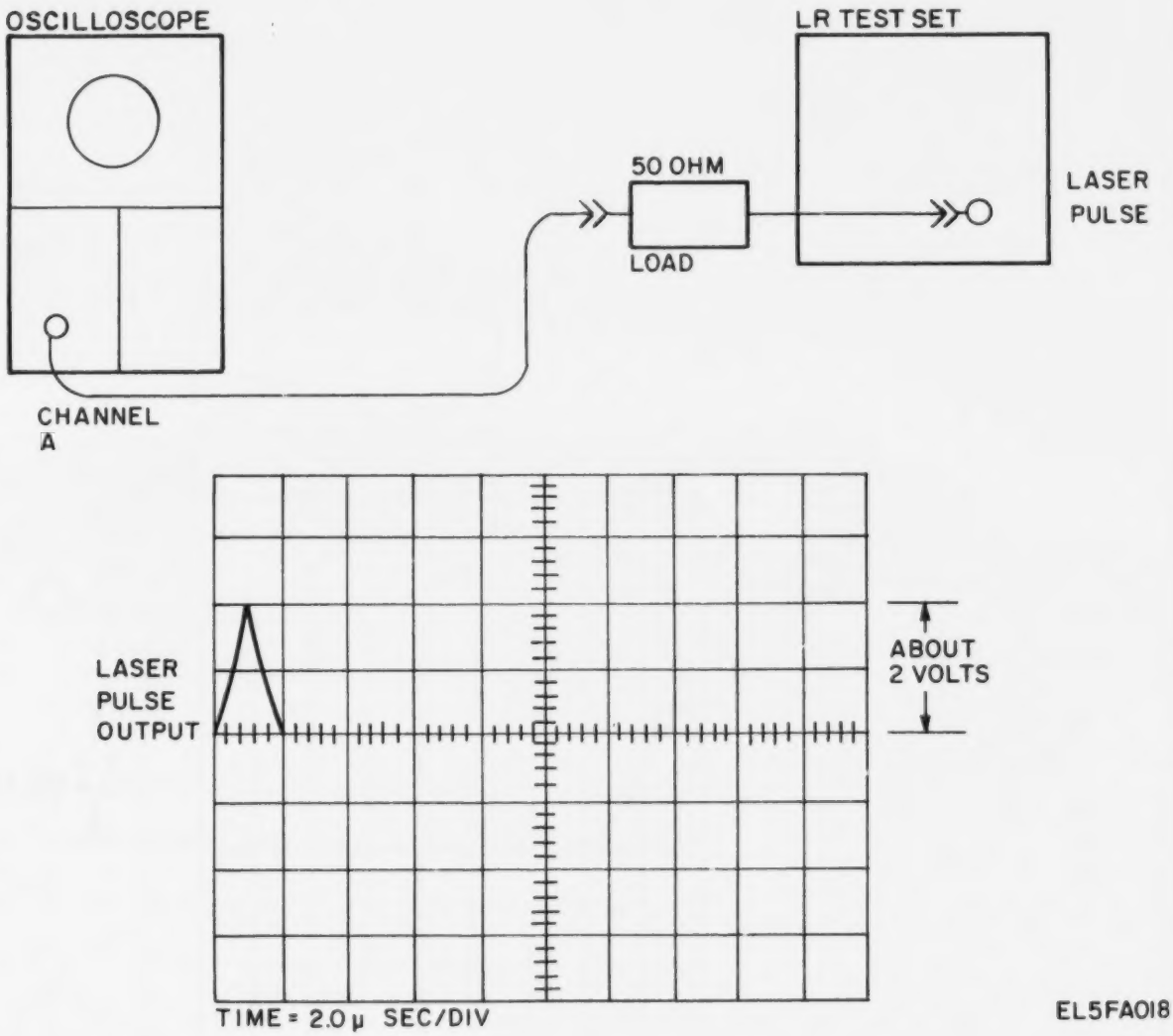


Figure 3-10. Laser Pulse Test Setup and Display.

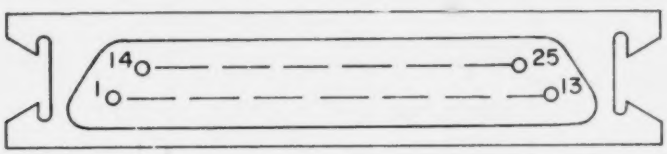
3-10. MODE Switch S1/Plug W1P1 Continuity Measurements
(fig. 3-11 and 3-12)

a. Measurements. The measurements for the MODE Switch are shown in figure 3-11. The terminal locations are shown in figure 3-12.

b. Test Setup.

(1) Only two, S1A and S1B, of three wafers are used. Wafer S1A is next to the panel when mounted, S1B is the mid wafer and S1C is furthest from the panel.

(2) A full test of the switch requires that all five rotary positions be checked.



POSITION	MODE	SIA FROM	SIA TO	SIB FROM	SIB TO	SIC
1	1 TGT	W1P1-21	W1P1-2	W1P1-1	W1P1-9	NOT
2	2 TGT	W1P1-21	W1P1-2	W1P1-1	W1P1-25	USED
3	RCVR 1 PULSE	W1P1-21	W1P1-17	W1P1-1	W1P1-11	
4	RCVR 2 PULSE	W1P1-21	W1P1-17	W1P1-1	W1P1-25	
5	LASER PULSE MONITOR	W1P1-21	W1P1-2	W1P1-1	W1P1-9	

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Figure 3-11. MODE Switch S1 Plug W1P1 Wiring Diagram.

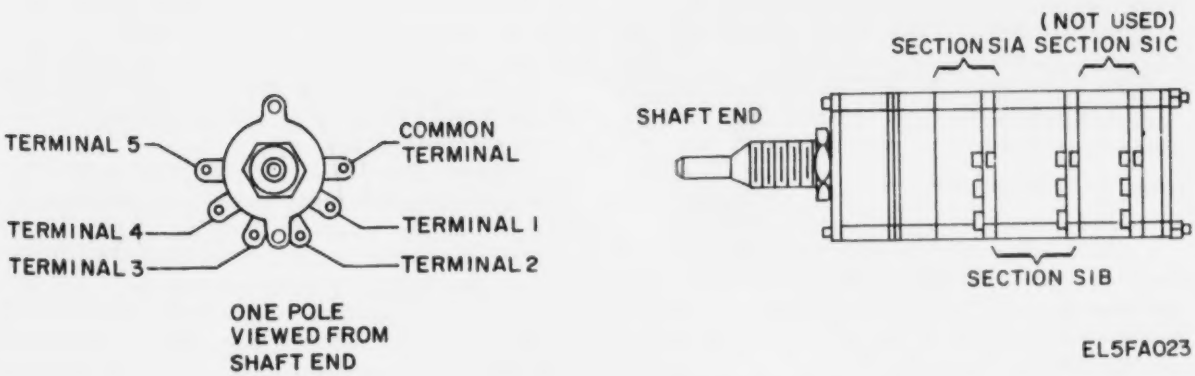


Figure 3-12. MODE Switch S1 Temrinal Location Diagram.

Section II. TOOLS AND TEST EQUIPMENT

3-11. Tools and Test Equipment

The tools which are required but not furnished as part of TK-100/G and TK-105/G are shown in table 3-2. The test equipment required to test and repair the LR Test Set is shown in table 3-2. The tools and equipment are in addition to that shown in TM 11-5860-2684-12.

Table 3-2. Special Tools and Test Equipment

Item	NSN	Reference		Use
		Fig. No.	Para No.	
LASER INFRARED OBSERVATION DEVICE AN GVS-5.	5860-01-062-3543	3-7	3-7	Used to check the LR Test set optics and electronics.
OSCILLOSCOPE AN USM-281	6625-00-228-2207	3-4	3-4	Waveform display checks.
MULTIMETER AN/USM-223	6625-00-999-7465	3-7	3-3	Voltage and resistance measurements.
POWER SUPPLY PP-3940A/G	6130-00-460-2148	3-7	3-7	Test dc power source used in lieu of 24 V battery.
VOLTMETER, DIGITAL AN/GSM-64B	6625-00-002-7894	3-7	3-3	Voltage measurements.
RESISTOR, 240 ohms, 14 watts.	5905-00-851-8571	3-13	3-17	Test load for adapter cable assembly test.
LEADS, test, alligator/spade clips.	Cramer Cat. 672 83330	3-13	3-17	Connect equipment if needed.
PUNCH, drive pin 1/16"	5120-00-240-6082	3-19	3-38	Drive the spring pin out of alinement bracket assembly mounting stand.
MULTIMETER AN/URM-105	6625-00-581-2036			To measure the front-to-back resistance ratio of diode.

Section III. TROUBLESHOOTING

3-12. Introduction

This section gives the rules needed to repair the LR Test Set. The figures and diagrams needed are also given. Repair personnel will make a visual check and then the Pass/Fail Test (operational check) to find the malfunction. Where required, a reference is made to the removal and replacement of a faulty part. Where a fault can be repaired which is covered in the TM 11-6625-2684-12, the reference is made. Where a repair is beyond the scope of this manual, send the LR Test Set to the Depot. In such case, the LR Test Set must be fully assembled when shipped to the Depot. After a repair is made, including the removal and the replacement of a faulty part, a complete retest of the LR Test Set is required.

3-13. Visual Inspection

(fig. 2-1)

a. Check the outside surface of the cover (6) and the base (20) for damage. If there is need for paint touchup, go to TM 11-6625-2684-12. If there is damage to the cover or the base other than paint, send the LR Test Set to the Depot.

b. Inspect the decals and identification plates on the outside surface of the LR Test Set. If the Test Set Identification Plate is damaged, go to paragraph 3-40. If the calibration tag is missing or defaced, the test set requires recalibration.

c. Press the pressure relief valve red button. If faulty, go to paragraph 3-33.

d. Release the two latches (29) from the two catches (16). Open the cover and slide it off from the base. If the latches, catches, or hinges are faulty, send the LR Test Set to the Depot.

e. Remove the alinement bracket assembly (3) from the mounting bosses on the hinged lid of the ac power cable assembly storage compartment (1). Check the threads on the screws for burrs, the stow lock switch for turn and snap-in, the cable (lanyard) for security and the stand for distortion. If faulty, go to paragraph 3-39.

f. Release the slide latches of the ac power cable assembly storage compartment. If the latches or the hinged lid, the hinge, or lettering on the lid, are damaged, obscured, or distorted, send the LR Test Set to the Depot. Open the compartment and take out the ac power cable assembly (2). Inspect it for bent, broken or missing pins, cut or broken insulation, wires and sheathing. If the assembly is damaged, replace it. Look at the cushions in the compartment. Check for twists, cracks, tears, and

for less than complete grip to the mounting surface. If the cushions are damaged, go to paragraph 3-31.

g. Release the slide latches of the ACA storage compartment (5). If the latches, the hinged lid, hinge or instruction label (plate) are damaged, smeared or twisted, send the LR Test Set to the Depot. Open the compartment and take out the ACA (4). Inspect it for bent, broken or missing pins, cut or broken insulation, wires, and sheathing, smeared or damaged label, missing screws, cross-threaded cap, twisted spring, or punctured or damaged case. If damaged, go to paragraph 3-41. Examine the cushions in the compartment. Check for twists, cracks, tears, and less than complete grip to the mounting surface. If the cushions are damaged, go to paragraph 3-31.

h. Check the mounting of the ground terminal E1 (11). If the terminal or its mounting is faulty, go to paragraph 3-37.

i. Check the MODE switch (17) for knob mounting and (turning) operation. If the switch is faulty, go to paragraph 3-25.

j. Check the RESET switch (19) for mounting and push operation. If the switch is faulty, go to paragraph 3-21.

k. Check the LASER OUTPUT LOW (21) and NORMAL (22) indicators for mounting and press operation. Also, take the lens off counterclockwise (CCW) and look inside the lens for the lamps. If a lamp is missing, put in a new one. If the indicators are faulty, go to paragraph 3-21.

l. Check the ON/TRIPPED OFF circuit breaker (23) for mounting and mechanical operation. If the circuit breaker is faulty, go to paragraph 3-27.

m. Check the PWR (26), LASER PULSE (12), RCVR SYNC PULSE (13), and TGT SYNC PULSE (14) jacks for mounting and the shape of the pins. If the PWR jack is faulty, go to paragraph 3-29. If the LASER PULSE jack is faulty, send the LR Test Set to the Depot. If either the RCVR SYNC PULSE or the TGT SYNC PULSE jacks are faulty, go to paragraph 3-30.

n. Check the two optic windows (28) for chipping and cracks. If any are seen, go to paragraph 3-34.

o. Check the optical shroud (9) for splits, cracks and twist. If faulty, go to paragraph 3-34.

p. Check the mounting security of the alinement bracket assembly mount (10). If the mount or its mounting hardware are faulty or missing, go to paragraph 3-39.

q. Check the mounting of both handles (24). If the handles or the mounting are faulty, go to paragraph 3-35.

r. Check the PWR ON indicator (25) for mounting. Check the red lens for cracks. Take off the lens (CCW) and look inside it for a lamp. If the lamp is missing, put in a new one (TM 11-6625-2684-12). If the socket is damaged, go to paragraph 3-28. Screw the lens, with the lamp inside, back on to the socket for snug fit clockwise (CW).

s. Check the warning decal (27) for damage and that it is clear to read. If faulty, go to TM 11-5860-2684-12.

NOTE

Whenever the LR Tester (8) is removed from the base, the checks in *t*, *u*, and *v* will be made.

t. Open the LR Test Set. Check the EMI gasket (15) for breaks, cuts, and secure attachment. If faulty, go to paragraph 3-32. Look inside the base. Remove any metal particles, dirt, or foreign material left inside the bottom of the base.

u. Inspect the printed circuit boards A2 and A3 (14 and 24, fig. 2-2) for mounting security, loose connections, burnt insulation, and cracked and broken boards. If the boards are faulty, replace them (para 3-22 for A2), (para 3-23 for A3). If only the printed circuit board mounting bushings are faulty, go to paragraph 3-38. Check for broken and frayed wires and replace if required.

v. Check for the presence of the power supply board assembly A3 voltage label (22). If the label (fig. 3-2) is missing or cannot be read clearly, send the LR Test Set to the Depot.

3-14. Pass/Fail Test Preparation (fig. 2-1)

a. Perform an operational check of the LR (TM 11-5860-201-10).

b. Open the LR Test Set.

c. Remove the alinement bracket assembly (3).

d. Remove the ac power cable assembly (2).

e. Remove the ACA (4).

CAUTION

Be sure that the ON/TRIPPED OFF circuit breaker (23) is set to TRIPPED OFF and that the power supply is set to off.

f. Connect the ac power cable assembly to the LR Test Set PWR jack (26). Connect the other end of the ac power cable assembly to a 115 vac, 0.5 ampere, 50-420 Hz electrical power source. If the PWR ON (25) indicator comes on, replace the circuit breaker (para 3-27).

g. Attach the alinement bracket assembly to the LR Test Set mounting post (fig. 3-8).

h. Check that the battery is removed from the LR battery container. Remove the lens protector assembly from the LR front lens, and the eyepiece cover from the rubber eyeshield.

i. Mount the LR in the vee grooves on the alinement bracket assembly. Press it firmly into the optical shroud. Tighten the mounting.

j. Connect the power supply, to the ac power source. Set the output voltage to 25.0 ±1.0 volts. Turn the power supply off.

k. Connect the ACA to the power supply.

l. Insert the adapter end of the ACA into the LR battery container. Turn the ACA cap finger-tight.

m. Set the LR PWR ON switch to off.

n. Set power supply to on.

o. Set the LR PWR ON switch to PWR ON.

p. Look into the LR eyepiece. Press and hold the MIN RNG switch and watch the LOW BATT indicator. If the display comes on and LOW BATT indicator stays off, the test equipment is ready for the Pass/Fail Test. If the LOW BATT indicator comes on and there is no display, go to malfunction 12 table 3-3. If the LR is mounted on the LR Tester, remove the ACA from the LR and disconnect it from the power supply.

3-15. Pass/Fail Test

(fig. 2-1)

Before starting this test, paragraphs 3-13 and 3-14 must be done. Test and troubleshoot in accordance with the following plan. The plan directs the test by consecutive alphabetical steps; i.e., subparagraph *a*, *b*, *c*, etc. Each step requires a test which in turn requires an answer or action. The first possible answer (i.e., subparagraph (1)) is a Pass, which sends the test technician to the next alphabetical step. The next possible answers (i.e., subparagraph (2), or (3), or (4)) is a Fail, telling the test technician to take some action. Release the control or switch used at the end of each step. After a trouble, fault, or malfunction has been repaired, go back to the start of the test and retest. Make sure any wires previously disconnected, are reconnected.

a. Set the ON/TRIPPED OFF circuit breaker (23) to ON.

(1) If the circuit breaker stays ON, go to step *b*.

(2) If the circuit breaker trips, go to malfunction 1, table 3-3.

b. Look at the PWR ON (25) indicator.

(1) If the indicator is on, allow at least 20 minutes warming time, and go to step *c*.

(2) If the indicator fails to come on, go to malfunction 2, table 3-3.

c. Set the MODE switch to 1 TGT. Look at the two LASER OUTPUT indicators, LOW (21), NORMAL (22), and press the RESET switch (19).

(1) If both indicators stay off, go to step *d*.

(2) If any indicator is on, go to malfunction 3, table 3-3.

d. Press the NORMAL and LOW indicators.

(1) If the NORMAL indicator and LOW indicator come on when pressed go to step *e*.

(2) If either indicator fails to come on, replace the faulty lamp, or socket (para 3-21).

(3) If both indicators fail to come on, go to malfunction 4, table 3-3.

e. Look at the two LASER OUTPUT indicators and press and hold the FIRE switch to the second click (firing) position.

(1) If the NORMAL indicator comes on, and the LOW indicator stays off go to step *f*.

(2) If both indicators come on, replace the electronics board assembly A2 (para 3-21).

(3) If both indicators stay off, go to malfunction 5, table 3-3.

(4) If the LOW indicator comes on and the nor-

mal indicator stays off, refer to malfunction 6, table 3-3.

f. Look into the LR for the RANGE-METERS reading and the MULT TGT light. Make sure the MIN RNG control is fully CCW. Press the RESET switch. Press and hold the FIRE switch to the second click (firing) position.

(1) If the reading is between 4,600 and 5,000 meters and the MULT TGT light stays off, go to step *g*.

(2) If the range reading is 000 and the MULT TGT light stays off, go to malfunction 7, table 3-3.

(3) If the reading is not between 4,600 and 5,000 meters, not 000 and the MULT TGT light stays off, replace the electronics board assembly A2 (para 3-21).

(4) If the MULT TGT light comes on, go to malfunction 8, table 3-3.

g. Set the MODE switch (17) to 2 TGT, and press the RESET switch. Look into the LR. Look at the MULT TGT light, and the RANGE-METERS display. Press and hold the FIRE switch to the second click (firing) position.

(1) If the MULT TGT light comes on and the range shown is between 4,600 and 5,000 meters, go to step *h*.

(2) If the MULT TGT light fails to come on, go to malfunction 9, table 3-3.

h. Press the RESET switch. Connect the equipment and set the controls as shown in figure 3-7. Set the MODE switch to 1 TGT. Look at the pulse output display on the oscilloscope at the start of the sweep. Press the FIRE switch to the second click (firing) position.

(1) If the momentary display is as shown in figure 3-7 while firing, go to step *i*.

(2) If the momentary display fails to show as in figure 3-7 while firing, go to malfunction 10, table 3-3.

i. Set the MODE switch to RCVR 1 PULSE and look at the pulse output display on the oscilloscope at the start of the sweep.

(1) If the display is as shown in figure 3-7, go to step *j*.

(2) If the display fails to show as in figure 3-7, go to malfunction 8, table 3-3.

j. Set the MODE switch to RCVR 2 PULSE and look at the pulse output display on the oscilloscope at the start of the sweep.

(1) If the display is as shown in figure 3-7, go to step *k*.

(2) If the display fails to show as in figure 3-7, remove the LR Tester from the base, check the wiring, and the MODE switch (para 3-24).

k. Connect the equipment and set the controls as shown in figure 3-9. Set the MODE switch to 1 TGT. Look at the pulse output display on the oscilloscope at the start of the sweep. Press the FIRE switch to the second click (firing) position.

(1) If the momentary display is as shown in figure 3-9 while firing, go to step *l*.

(2) If the momentary display fails to show as in figure 3-9 while firing, go to malfunction 11, table 3-3.

l. Connect the equipment and set the controls as shown in figure 3-10. Set the MODE switch to LASER PULSE MONITOR. Look at the pulse output display on the oscilloscope at the start of the sweep. Press the FIRE switch to the second click (firing) position.

(1) If the momentary display is as shown in figure 3-10, while firing, the LR Tester is good, go to paragraph 3-18 for shutdown.

(2) If the momentary display fails to show as in figure 3-10 the XMT/RCV assembly A1 is faulty. Turn off the power, remove all cables, reassemble the LR Test Set, and send it to the Depot.

3-16. Adapter Cable Assembly Test
(fig. 3-13)

a. Turn on the power supply. Measure and set the output voltage to 24.0 +0.1 V. Turn off the power supply. Connect the ACA and the test equipment. Make sure the leads have the right polarity (red +, black −), and turn on the power supply.

(1) If the measurement across the load resistor is 23.3 ± 0.5 volts, go to step b.

(2) If the measurement across the load resistor is 0.0V, go to malfunction 12, table 3-3, step 1.

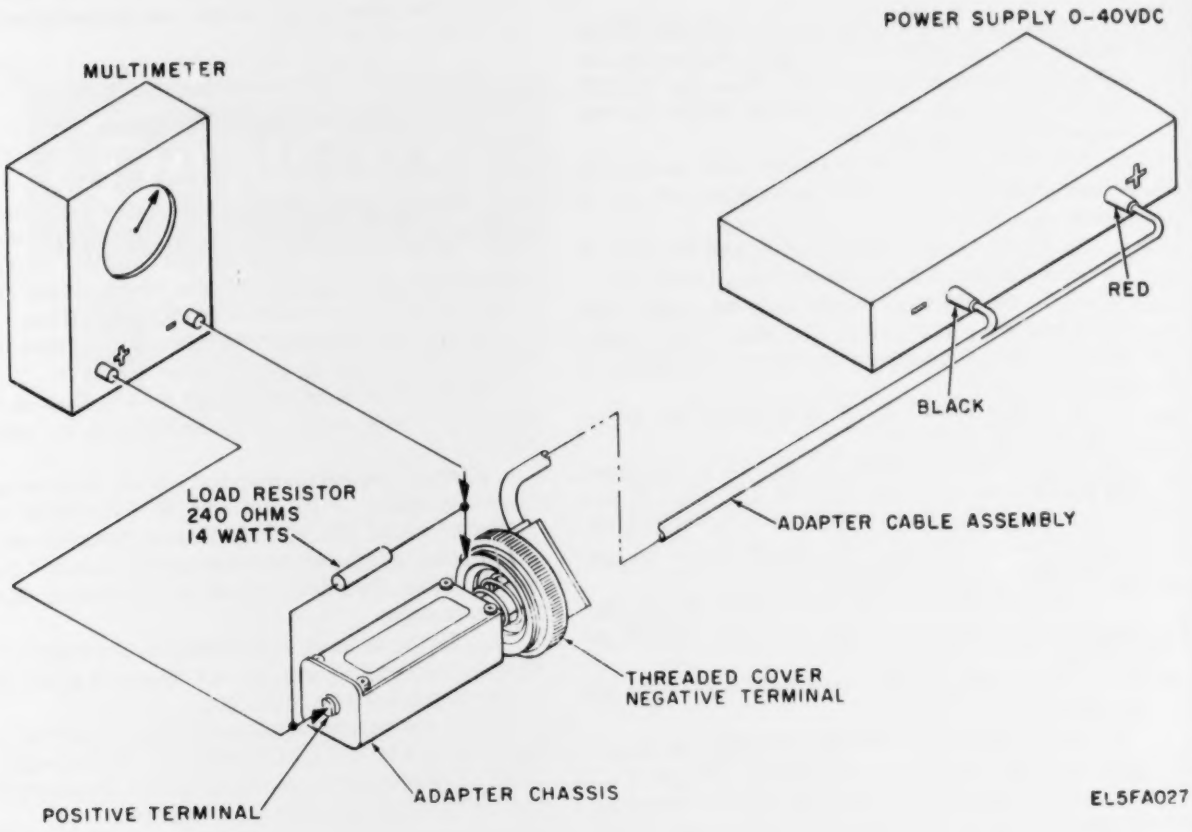


Figure 3-13. Adapter Cable Assembly Test Setup.

b. Turn off the power supply. Reverse (swap) the ACA leads. Turn on the power supply.

(1) If the measurement across the load resistor is 0.0 V, go to step *c*.

(2) If the measurement across the load resistor is other than 0.0V, refer to malfunction 12, table 3-3, step 2.

c. Turn off the power supply. Remove the load resistor only. Change the test leads back to the first connections of step *a* above. Turn on the power supply which will measure 24.0 ±0.1 V. While looking at the multimeter, turn off the power supply.

(1) If the voltage measurement drops exponentially (capacitor discharge rate) to 0.0V, taking thirty seconds or more time, the ACA is good. Go to paragraph 3-18 for shutdown.

(2) If the voltage measurement drops immediately to 0.0V or in less than thirty seconds time, go to malfunction 12, table 3-3, step 3.

3-17 Corrective Action

Go to table 3-3 for the action to correct the malfunctions found during the Pass/Fail Test. Adjust, fix, replace, or send the equipment to the Depot as instructed. After a correction, including part replacement, go back to the first test step and retest. Most corrections require access to the parts on the LR Tester. Take the LR Tester out of the base (para 3-1).

Table 3-3. Troubleshooting Procedure

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

LR TESTER

NOTE

When troubleshooting this equipment, use figures 2-1, 2-2, and FO-3.

1. **ON/TRIPPED OFF CIRCUIT BREAKER TRIPS.** (23, fig. 2-1)

Step 1. *PWR ON Indicator Lamp (25) Check:* Unscrew and remove the red indicator lens, with lamp inside, from the PWR ON indicator socket XDS1. Set the circuit breaker to ON.

a. If the circuit breaker trips, go to step 2.

b. If the circuit breaker stays ON, set it to TRIPPED OFF. Install a new lamp. Screw the lens into the PWR ON indicator lamp socket. Set the circuit breaker to ON. If the circuit breaker stays ON and the PWR ON indicator comes on, the malfuntion is repaired. If the circuit breaker trips, go to step 2.

Step 2. *PWR ON Indicator Socket XDS1 CB1 Tripped Off Check:* Remove the ac power cable assembly (2) from the PWR jack (26). Remove the red indicator lens/lamp assembly. Measure the resistance from the socket center pin (terminal 1) to pin A of the PWR jack.

a. If the measurement is an open circuit, go to step 3.

b. If the measurement is 62.0 K ohm ±15%, replace CB1 (para 3-27).

Step 3. *PWR ON Indicator Socket XDS1 CB1 ON Check:* Measure the resistance from the socket center pin (terminal 1) to pin A of the PWR jack.

a. If the resistance is 62.0 K ohms, ±15%, go to step 4.

b. If the resistance is not 62.0 K ohms, ±15%, replace the socket (para 3-28).

Step 4. *PWR ON Indicator Socket XDS1 CB1 ON Full Check:* Measure the resistance from the indicator socket barrel, terminal 2, to pin C of the PWR ON jack.

a. If the measurement is a short circuit, go to step 5.

b. If the measurement is an open circuit, replace CB1 (para 3-27).

Step 5. *PWR ON Indicator Socket XDS1 CB1 Tripped Off Check:* Measure the resistance from the indicator socket barrel, terminal 2, to pin C of the PWR ON jack.

a. If the measurement is an open circuit, go to step 6.

b. If the measurement is a short circuit, replace CB1 (para 3-27).

Step 6. *Filter FL1 Check (1, fig. 2-2)* Remove the LR from the LR Tester. Remove the adapter. Remove the LR Tester (para 3-1). Remove TB1 (3), insulator and cover. Remove the tag the filter FL1 (1) wire from TB1-5. Remove and tag the filter FL2 (2) wire from TB1-7. Remove and tag the wires from TB1-6, TB1-8, and the jumper wires. Verify that the ac power cable assembly is not on the PWR jack. Set the circuit breaker to ON. Check for an open circuit between FL1 wire to the electronic chassis ground.

a. If the measurement is an open circuit, go to step 7.

b. If the measurement is a short circuit, replace filter FL1 (para 3-26).

Step 7. *Filter FL2 Check:* Check for an open circuit between filter FL2 wire to the electronic chassis ground.

a. If the measurement is an open circuit, go to step 8.

b. If the measurement is a short circuit, replace filter FL2 (para 3-26).

Step 8. *Power Input Circuit Check:* Measure the continuity of the power input circuit.

a. If the continuity test is good, go to steps 9 and 10 as required.

b. Repair/replace the fault (section IV).

Step 9. *Transformer T1 Primary Coil Check:* Measure the resistance between TB1-5 and TB1-7 (transformer input coil wires); and TB1-5 to chassis ground; and TB1-7 to chassis ground.

a. If the measurement is 23.0 ohms, ±15% resistance between TB1-5 and TB1-7; an open circuit from TB1-5 to chassis ground and an open circuit from TB1-7 to chassis ground, go to step 10.

b. If any measurement is faulty, replace transformer T1 (para 3-20).

Step 10. *Transformer T1 Secondary Coils Check:* Disconnect plug P2 from jack A3J1 (25). Measure the resistance from P2-9 to P2-10 and; from P2-4 to P2-5 and; between P2-4, P2-5, P2-9 and P2-10 to chassis ground.

a. If the measurement between P2-9 and P2-10 is 87.0 ohms, ±15%; and between P2-4 and P2-5 is 0.8 ohms, ±15%; and open circuits exist between P2-4 to ground, P2-5 to ground, P2-9 to ground, and P2-10 to ground, send the LR Test Set to the Depot.

b. If any measurement is faulty, replace transformer T1 (para 3-20).

2. **PWR ON INDICATOR FAILS TO COME ON.** (25 and 23, fig. 2-1)

Step 1. *Missing Lamp Check:* Unscrew the red indicator lens/lamp assembly and remove it.

a. If the lamp is inside the lens, go to step 2.

b. If there is no lamp inside the lens, put a good lamp inside the lens. Screw the lens, with the lamp inside, into its socket.

Step 2. *Indicator Socket XDS1 Press-To-Test (PTT) Check:* Press the LASER OUTPUT NORMAL (22) or the LASER OUTPUT LOW (21) indicator.

a. If the indicators fail to come on, go to step 3.

b. If either of the indicators come on, replace the PWR ON indicator socket XDS1 (para 3-28).

Table 3-3. Troubleshooting Procedure—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. *Power Source Check:* Set the ON/TRIPPED OFF circuit breaker to TRIPPED OFF. Remove the ac power cable assembly (2) from the PWR jack (26). Measure the input source ac power at the input power connector.

a. If the measured power source is 115 ±10% vac, go to step 4.

b. If the measured power source is not 115 ±10% vac, fix/repiace it.

Step 4. *AC Power Cable Assembly Check:* Check the continuity of the conductors and connectors in the ac power cable assembly.

a. If the ac power cable assembly is good, go to step 5.

b. If the ac power cable assembly is faulty, replace it.

Step 5. *ON/TRIPPED OFF Circuit Breaker Half Circuit Check:* Set the circuit breaker to TRIPPED OFF. Remove the ac power cable assembly from the PWR jack. Measure the resistance between the PWR jack pin A first pin clockwise from the jack keyway), and the center pin of the PWR ON socket XDS1.

a. If the resistance measures an open circuit when the circuit breaker is set to TRIPPED OFF, and then measures 62.0 K ohms when the circuit breaker is set to ON, go to step 6.

b. If the resistance measures an open circuit whether or not the circuit breaker is set to ON or TRIPPED OFF, replace the circuit breaker (para 3-27).

Step 6. *Socket, Connector and Other Half Circuit Breaker Check:* Measure the resistance between the PWR jack pin C (first pin counterclockwise from the jack keyway) and the ground barrel of the PWR ON socket XDS1. If the measurement is an open circuit when the circuit breaker is set to ON, remove the LR Tester from the base (para 3-1). Troubleshoot the input circuit; repair/replace the fault.

3. NORMAL OR LOW INDICATORS REMAIN ON WHEN THE RESET SWITCH IS PRESSED IN THE 1 TGT MODE. (19 and 21 or 22, fig. 2-1)

Step 1. *RESET Switch Check:* Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Remove plug W1P1 from jack A2J1 (10, fig. 2-2). Measure the continuity between W1P1-4 and W1P1-10 (figs. 3-11 and 3-15) while the RESET switch is pressed and then released.

a. If the measurement shows continuity only when the switch is pressed, put plug W1P1 back onto jack A2J1. Go to step 2.

b. If the measurement shows constant continuity or constant open circuit despite the switch operation, replace the switch (para 3-21).

Step 2. *Electronics Board Assembly A2 and XMT/RCV Assembly A1 Check:* Remove plug A1P2 from jack A2J2 (12) and plug A1P3 from jack A2J3 (13). Connect the power cable assembly to the PWR jack. Set the circuit breaker to ON. Press the RESET switch. Look at the LASER OUTPUT indicators.

a. If any one of the indicators remains on, set the circuit breaker to TRIPPED OFF. Replace the electronics board assembly A2 (para 3-22).

b. If both indicators stay off, set the circuit breaker to TRIPPED OFF. The XMT/RCV assembly A1 is faulty. Send the LR Test to the Depot.

4. BOTH INDICATORS FAIL TO COME ON WHEN PRESSED. (21 and 22, fig. 2-1)

Step 1. *Power Supply Board Assembly A3 Voltage Check:*

NOTE

When the LR Test Set is calibrated, the power supply board assembly A3 voltages are recorded on the power supply board assembly A3 voltage label. The label is located as item 22, figure 2-2. When the assembly is replaced, the new assembly voltages must be set to the voltages shown on the label.

Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Connect the ac power cable assembly to the PWR jack. Set the circuit breaker to ON. Using a digital voltmeter, measure the test points shown in table 3-1.

a. If the measured voltages are not as shown in table 3-1, set the circuit breaker to TRIPPED OFF. Go to step 2.

b. If the measured voltages are as shown in table 3-1, check the wiring between the LASER OUTPUT NORMAL indicator DS2 (4, fig. 2-2), the LASER OUTPUT LOW Indicator DS3 (5), and the power supply board assembly A3 (24). Repair/replace the fault.

Step 2. *TB1-3/TB1-4 Voltage Check:* Set the circuit breaker to ON. Measure ac volts across TB1-3 to TB1-4.

a. If the TB1-3/TB1-4 measurement is 0.0 vac, go to step 3.

b. If the TB1-3/TB1-4 measurement is between 11.0 and 14.2 vac, replace the power supply board assembly A3 (para 3-23).

Step 3. *TB1-5/TB1-7 Voltage Check:* Measure ac volts across TB1-5 to TB1-7.

a. If the TB1-5/TB1-7 measurement is between 104.5 and 126.5 vac, replace transformer T1 (para 3-20).

b. If the TB1-5/TB1-7 measurement is not between 104.5 and 126.5 vac, filter FL1 (1) or filter FL2 (2) is faulty. Go to malfunction 1, step 6.

Table 3-3. Troubleshooting Procedure – Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

5. BOTH LASER OUTPUT INDICATORS STAY OFF. (21 and 22, fig. 2-1)

Step 1. *Power Supply Board Assembly A3 Voltage Check:*

NOTE

When the LR Test Set is calibrated, the power supply board assembly A3 voltages are recorded on the power supply board assembly A3 Voltage Label. The label is located as item 22, figure 2-2. When the assembly is replaced, the new assembly voltages must be set to the voltages shown on the label.

Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Connect the ac power cable assembly on the PWR jack. Set the circuit breaker to ON. Using a digital voltmeter measure the test points shown in table 3-1.

a. If the measured voltages are as shown in table 3-1, go to step 2.

b. If the measured voltages are not as shown in table 3-1, set the circuit breaker to TRIPPED OFF. Replace the power supply board assembly A3 (para 3-23).

Step 2. *Electronics Board Assembly A2 and XMT/RCV Assembly A1 Check:* Set the circuit breaker to TRIPPED OFF. Remove plug A1P2 from jack A2J2 (12, fig. 2-2) and place to one side. Connect a jumper wire from the center contact on A2J2 to a convenient or chassis ground (4, Appx B). Set the circuit breaker to ON. Look at the LASER OUTPUT NORMAL indicator and press the RESET switch.

a. If the indicator stays off, replace the electronics board assembly A2 (para 3-22).

b. If the indicator comes on, the XMT/RCV assembly A1 is faulty. Turn off the power. Disconnect the power cable. Reassemble the LR Test Set and send it to the Depot.

6. THE LOW INDICATOR COMES ON. (21 and 22, fig. 2-1)

Step 1. *Cable Connection Check:* Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Look at conectors A2J2/A1P2 (12, fig. 2-2) and A2J3/A1P3 (13).

a. If the connectors are correctly mated, go to step 2.

b. If the connectors are reversed, disconnect and reconnect correctly.

Step 2. *Power Supply Board Assembly A3 Voltage Check:*

NOTE

When the LR Test Set is calibrated, the power supply board assembly A3 voltages are recorded on the power supply board assembly A3 voltage label. The label is located as item 22, figure 2-2. When the assembly is replaced, the new assembly voltages must be set to the voltages shown on the label.

Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Connect the ac power cable assembly to the PWR jack. Set the circuit breaker to ON. Using a digital voltmeter measure the test points shown in table 3-1.

a. If the measured voltages are as shown in table 3-1, go to step 3.

b. If the measured voltages are not as shown in table 3-1, set the circuit breaker to TRIPPED OFF. Replace the power supply board assembly A3 (para 3-23).

Step 3. *Electronics Board Assembly A2 and XMT/RCV Assembly A1 Check:* Set the circuit breaker to TRIPPED OFF. Remove plug A1P2 from jack A2J2 (12, fig. 2-2) and place to one side. Connect a jumper wire from the center contact on A2J2 to a convenient or chassis ground (4, app B). Set the circuit breaker to ON. Look at the LASER OUTPUT NORMAL indicator and press the RESET switch.

a. If the indicator stays off, replace the electronics board assembly A2 (para 3-22).

b. If the indicator comes on, the XMT/RCV assembly A1 is faulty. Turn off the power. Disconnect the power cable. Reassemble the LR Test Set and send it to the Depot.

7. THE MULT TGT LIGHT STAYS OFF IN THE 1 TGT MODE. (14 and 24, fig. 2-2)

Step 1. *Power Supply Board Assembly A3 Voltage Check:*

NOTE

When the LR Test Set is calibrated, the power supply board assembly A3 voltages are recorded on the power supply board assembly A3 voltage label. The label is located as item 22, figure 2-2. When the assembly is replaced, the new assembly voltages must be set to the voltages shown on the label.

Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Connect the ac power cable assembly on the PWR jack. Set the circuit breaker to ON. Using a digital voltmeter measure the test points shown in table 3-1.

a. If the measured voltages are as shown in table 3-1, go to step 2.

b. If the measured voltages are not as shown in table 3-1, replace the power supply board assembly A3 (para 3-22).

Table 3-3. Troubleshooting Procedure—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. *TGT SYNC PULSE Display Check:* Go to paragraph 3-7 and make the LR Test Set TGT SYNC PULSE display check.

a. If the display is as shown in figure 3-7, go to step 3.

b. If the display is not as shown in figure 3-7, replace the electronics board assembly A2 (para 3-22).

Step 3. *1 TGT PULSE Display Check:* Remove plug A1P4 from jack A2J4 (16) and plug W3P6 from jack A2J6 (18). Connect W3P6 to A2J4. Repeat the TGT SYNC PULSE display check of step 2 above.

a. If the display is as shown in figure 3-7, the XMT/RCV board assembly A1 is faulty. Turn off the power, remove cables, reassembly the LR Test Set, and send it to the Depot.

b. If the display is not as shown in figure 3-7, replace the electronics board assembly A2 (para 3-22).

8. THE MULT TGT LIGHT COMES ON IN 1 TGT MODE; OR, OSCILLOSCOPE DISPLAY FAILS TO SHOW AS IN FIGURE 3-7 IN THE RCVR 1 MODE.

MODE Switch (11, fig. 2-2) or Electronics Board Assembly (14) Check: Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Remove plug W1P1 from jack A2J1 (10, fig. 2-2) at the electronics board assembly. Make continuity tests of all positions of the MODE switch (fig. 3-11). There are three wafers on the switch (fig. 3-12). Wafer S1A is the first wafer next to the electronic chassis front panel on which the switch is mounted. Wafer S1C, third wafer from the panel, is not used.

a. If the measurement is continuity for all five positions, (S1A and S1B wafer terminals are shown in figure 3-11), the MODE switch is good. Go to *b* below. If the switch is faulty, replace it (para 3-25).

b. Replace the electronics board assembly A2 (para 3-22).

9. MULT TGT LIGHT FAILS TO COME ON IN THE 2 TGT MODE.

Step 1. *MODE Switch (11, fig. 2-2) or Electronics Board Assembly (14) Check:* Set the LR PWR ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Remove plug W1P1 from jack A2J1 (10, fig. 2-2) at the electronics board assembly. Make continuity tests of all positions of the MODE switch (fig. 3-11). There are three wafers on the switch (fig. 3-12). Wafer S1A is the first wafer next to the electronics chassis front panel on which the switch is mounted. Wafer S1C, third wafer from the panel, is not used. Measure continuity for all five positions, S1A and S1B wafer terminals are as shown in figure 3-11.

a. If the MODE switch is good, go to step 2.

b. If the MODE switch is faulty, replace it (para 3-25).

Step 2. *XMT/RCV Assembly A1 and Electronics Board Assembly A2 Check:* Remove plug A1P4 from jack A2J4 (16, fig. 2-2) at the electronics board assembly A2 (14). Remove plug A1P5 from jack A2J5 (15). Stow the plug A1P5 out of the way (fig. 3-3). Put plug A1P4 on jack A2J5. Put the LR Tester in the base. Put the LR back on to the LR Tester. Put the ac power cable assembly on the PWR jack. Set the circuit breaker to ON. Let the LR Tester warm for at least five minutes. Set the LR PWR ON switch to on. Press the RESET switch (19, fig. 2-1). Look into the LR at the RANGE-METERS display. Press and hold the FIRE switch to the second click (firing) position.

a. If the range reading is not 000, the XMT/RCV assembly A1 is faulty. Turn off the power. Remove all cables. Unstow and reconnect plug A1P5 to jack A2J5. Reassemble the LR Test Set and send it to the Depot.

b. If the range reading is 000, replace the electronics board assembly A2 (para 3-22).

10. OSCILLOSCOPE MOMENTARY DISPLAY FAILS TO SHOW AS IN FIGURE 3-7 IN THE 1 TGT MODE.

Electronics Board Assembly A2 (14, fig. 2-2) or Cable W3 (19) Check: Set the LR POWER ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Remove plug W3P6 from jack A2J6 (18). Measure cable W3 continuity.

a. If the measurement shows continuity between jack W3J4 and plug W3P6, replace the electronics board assembly A2 (para 3-22).

b. If the measurement shows an open circuit between jack W3J4 and plug W3P6, replace cable W3 (para 3-30).

11. OSCILLOSCOPE MOMENTARY DISLAY FAILS TO SHOW AS IN FIGURE 3-9.

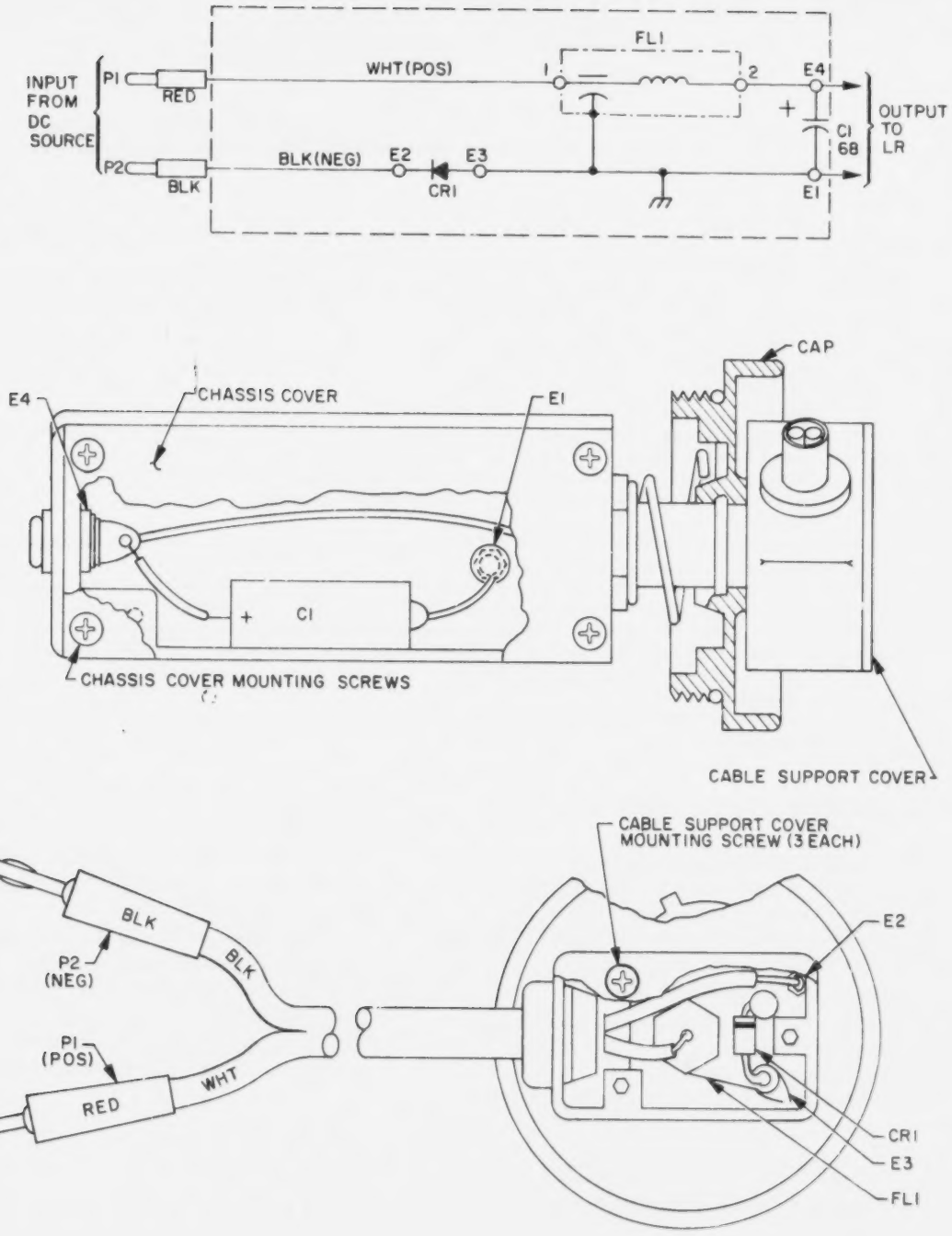
Electronics Board Assembly A2 (14, fig. 2-2) or Cable W2 (20) Check: Set the LR POWER ON switch to off. Set the ON/TRIPPED OFF circuit breaker (23, fig. 2-1) to TRIPPED OFF. Remove the LR from the LR Test Set. Remove the ac power cable assembly (2) from the PWR jack (26). Remove the LR Tester from the base (para 3-1). Remove plug W2P7 from jack A2J7 (17). Measure cable W2 continuity.

a. If the measurement shows continuity between jack W2J3 and plug W2P7, replace the electronics board assembly A2 (para 3-22).

b. If the measurement shows an open circuit between jack W2J3 and plug W2P7, replace cable W2 (para 3-30).

ADAPTER CABLE ASSEMBLY

12. ACAFAILS. (fig. 3-14)



NOTE:
UNLESS OTHERWISE SPECIFIED, CAPACITANCE VALUES ARE IN MICROFARADS.

EL5FA021

Figure 3-14. Adapter Cable Assembly Schematic and Part Location Diagrams.

Table 3-3. Troubleshooting Procedure—Continued

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

The ACA EMI filter FL1 and the ACA diode CR1 are mounted inside the round cable support box. The ACA capacitor C1 is mounted inside the battery-shaped box. Notice that all three parts are mounted to terminals for easy removal and replacement.

CAUTION

Capacitor C1 in the ACA will hold an electrical charge long after the power has been shut off. Discharge the capacitor before making any resistance measurements.

Step 1. *Filter FL1 Check:* Turn off the power supply. Remove the test leads from the power supply. Remove the load resistor from the test setup. Remove the multimeter leads from the assembly. To get at the filter and the diode, remove three mounting screws which hold the round cable support cover. To get the capacitor, remove four chassis cover mounting screws which hold the chassis cover. Desolder and lift off the capacitor lead at terminal E4. Put the multimeter common probe on the ACA ground connector P2 (black). Put the multimeter positive probe on the ACA positive connector P1 (red).

a. If the measurement is an open circuit, reconnect the capacitor lead to terminal E4 and go to step 2.

b. If the measurement is about 11 ohms (diode resistance), replace filter FL1 (para 3-42). Go to paragraph 3-16.

Step 2. *Diode CR1 Check:* Turn off the power supply. Remove the test leads from the power supply. Remove the load resistor from the test setup. Remove the multimeter leads from the assembly. Open the ACA as in step 1 above. Using the multimeter ohms scale make a front-to-back ratio measure of the diode.

a. If the front-to-back ratio is correct, go to step 3.

b. If the measurement shows a short circuit in both directions, or an open circuit in both directions, replace the diode (para 3-43). Go to paragraph 3-16.

Step 3. *Capacitor (C1) Check:* Turn off the power supply. Remove the test leads from the power supply. Remove the load resistor from the test setup. Remove the multimeter leads from the assembly. Open the ACA as in step 1 above. Desolder and lift off the capacitor lead at terminal E4. Short circuit the two capacitor leads to each other to discharge the capacitor. Using the multimeter ohms highest scale, make a continuity check in both directions of the capacitor.

a. If the measurement shows that the capacitor charges in both directions, the capacitor is good. Reconnect it, go to paragraph 3-18.

b. If the measurement shows a constant short circuit or a constant open circuit, replace the capacitor (para 3-45). Go to paragraph 3-16.

3-18. Shutdown After Troubleshooting (fig. 2-1)

At the end of troubleshooting or when told to send the test set to Depot, do the following steps. If a step is already done, go to the next step.

a. Set the ON/TRIPPED OFF circuit breaker (23) to TRIPPED OFF.

b. Set the power supply to OFF.

c. Set the LR PWR ON switch to off.

d. Remove the ACA (4) from the LR. Remove the wires from the power supply.

e. Remove the LR from the LR Test Set. Put on the LR lens cover and protective eyepiece caps. Put on the LR cover. Put on the battery container cover.

f. Put the LR Tester in the base (para 3-1).

g. Put the ACA in its storage compartment (5) in the cover (6).

h. Turn off the power to the test equipment. Remove and stow all the test cables.

i. Remove the ac power cable assembly (2) and the alinement bracket assembly (3). Put them in their storage compartment (1) in the cover.

j. Put the cover on the base and latch it.

SECTION IV. MAINTENANCE PROCEDURES

3-19. Parts Removal and Replacement (fig. 3-15)

CAUTION

Do not cut the wires.

This section has removal and replacement rules for the LR Test Set parts. Before doing any step, go to paragraph 3-1 to remove the LR Tester from the base. When a plastic cable clamp or tie is in the way, use a sharp knife or diagonal pliers to cut if off the wire bundle. Mark or make note where the clamp or tie was and on part replacement, put on a new clamp or tie (1, 2, or 3, app B). When the part has been replaced, make the Pass/Fail Test (para 3-15).

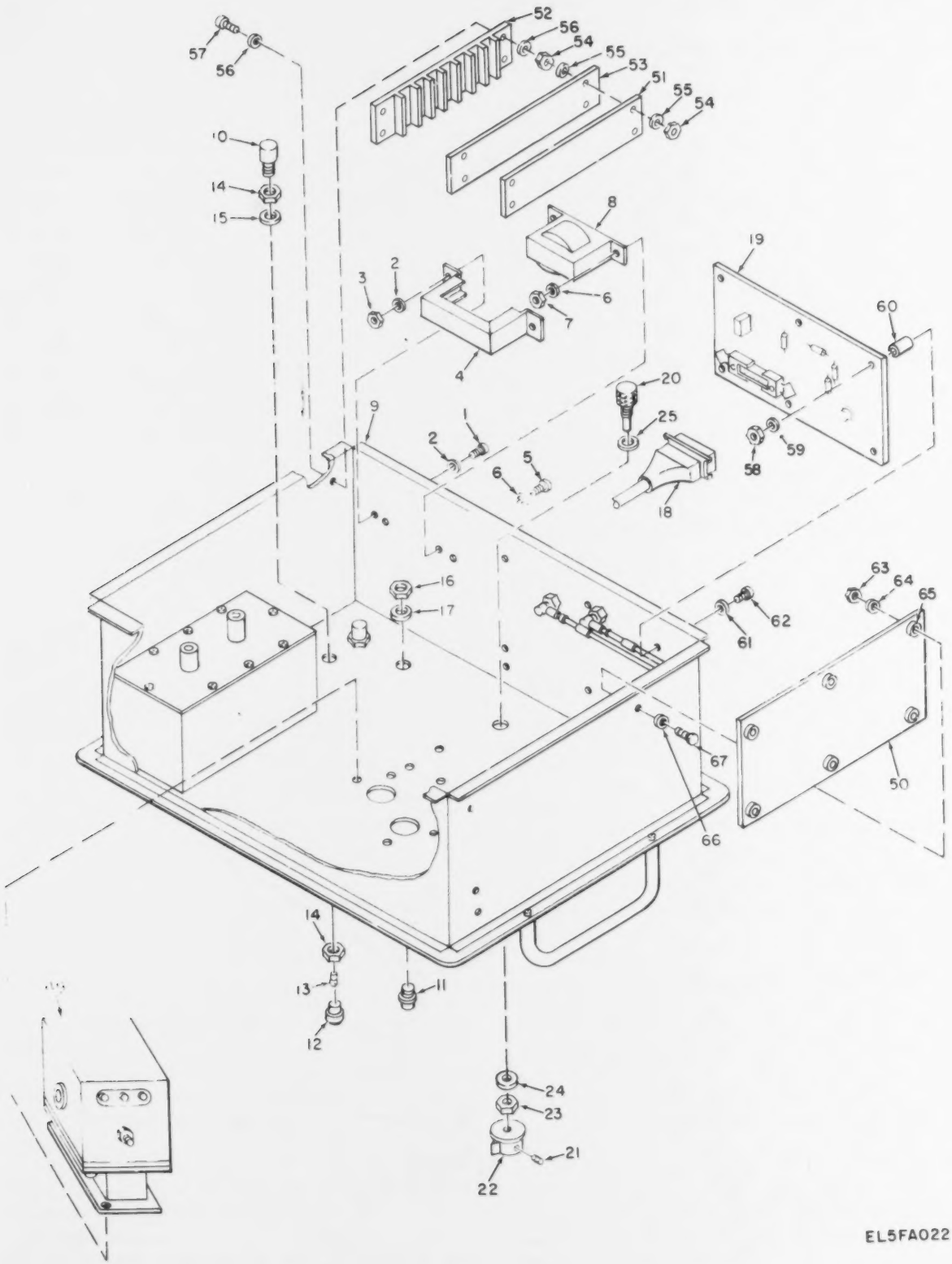


Figure 3-15 (1) LR Tester Exploded View (Sheet 1 of 2).

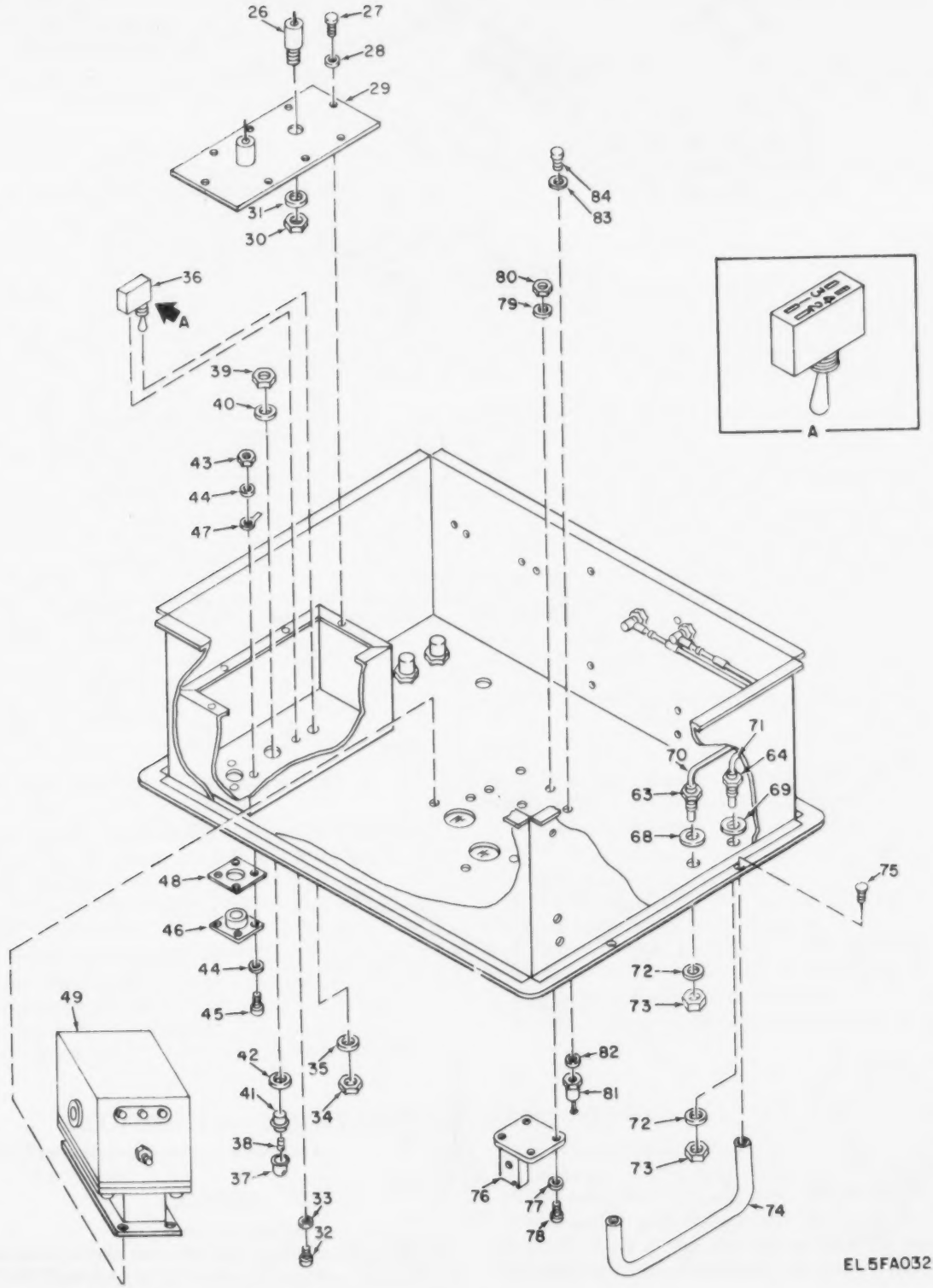


Figure 3-15 (2) LR Tester Exploded View (Sheet 2 of 2).

Legend for fig. 3-15:
1. Screw
2. Washer
3. Nut
4. Bracket
5. Screw
6. Washer
7. Nut
8. T1
9. Chassis
10. XDS2, XDS3
11. S2
12. Lens
13. Lamp
14. Nut
15. Washer
16. Nut
17. Washer
18. W1P1
19. A2
20. S1
21. Setscrew
22. Knob
23. Nut
24. Washer
25. O-ring
26. FL1, FL2
27. Screw
28. Washer
29. Cover
30. Nut
31. Washer
32. Screw
33. Washer
34. Nut
35. Washer
36. CB1
37. Lens
38. Lamp
39. Nut
40. Washer
41. XDS1
42. Gasket
43. Nut
44. Washer
45. Screw
46. J1
47. Terminal lug E2
48. Gasket
49. A1
50. A3
51. Cover
52. TB1
53. Insulator
54. Nut
55. Washer
56. Washer
57. Screw
58. Nut
59. Washer
60. Spacer
61. Washer
62. Screw
63. Nut
64. Washer
65. Spacer
66. Washer
67. Screw
68. J3
69. J4
70. W2
71. W3
72. Washer
73. Nut
74. Handle
75. Screw
76. Bracket Mount
77. Screw
78. Washer
79. Nut
80. Washer
81. E1
82. Washer
83. Washer
84. Screw

Figure 3-15. LR Tester Exploded View.

3-20. Transformer T1 Removal and Replacement

(fig. 3-15)

a. Removal.

(1) Remove transformer and transformer bracket mounting hardware (1, 2, 3, 5, 6, and 7) and bracket (4).

(2) Remove mounting hardware (54 and 55), insulator (53) and cover (51) from TB1.

(3) Disconnect and tag the transformer wires from TB1 (52).

(4) Remove transformer (8). Stow the bracket using hardware 1, 2, and 3 in the same holes. Stow hardware 5, 6, and 7 in the same holes.

b. Replacement.

(1) Unstow hardware (1, 2, 3, 5, 6, and 7) and bracket (4). Install T1 (8) with mounting hardware (5, 6, and 7) and bracket (4) with mounting hardware (1, 2, and 3).

(2) Connect the wires from T1 and TB1 and remove the tags.

(3) Install insulator (53) and cover (51) on TB1 with mounting hardware (54 and 55).

3-21. NORMAL Indicator XDS2 or Low Indicator XDS3 or RESET Switch S2 Removal and Replacement

(fig. 3-15)

a. Removal.

(1) Remove transformer T1 and transformer bracket mounting hardware (1, 2, 3, 5, 6, and 7) and bracket (4). Swing T1 (8) over the edge of the chassis (9) out of the way to get working room.

(2) Disconnect the wires to XDS2 or XDS3, (10) or S2 (11) and tag the wires.

NOTE

If removing the RESET switch S2 only, go to step (4).

(3) Remove the lens (12), lamp (13), mounting nut (14), washer (15) and XDS2 or XDS3.

(4) Remove mounting hardware (16 and 17) and S2 (11).

b. Replacement.

NOTE

If installing reset switch S2 (11) only, go to step (3).

(1) Install XDS2 or XDS3 (10) with mounting nut (14) and washer (15).

(2) Install the lamp (13) and lens (12).

(3) Connect the wires to XDS2, XDS3 or S2, and remove the tags.

(4) Install S2 (11) with mounting hardware (16 and 17).

(5) Install T1 (8) with mounting hardware (1, 2, 3, 5, 6, and 7) and bracket (4).

3-22. Electronics Board Assembly A2 Removal and Replacement

(fig. 2-2)

a. Removal.

(1) Disconnect W1P1 (10) from J1 on the electronics board assembly A2 (14).

(2) Disconnect the four coaxial cables: A1P2/A2J2 (12); A1P3/A2J3 (13); A1P4/A2J4 (16); and A1P5/A2J5 (15); from XMT/RCV assembly A1 (9) to the electronics board assembly A2.

(3) Disconnect coaxial connectors W2P7 from A2J7 (17).

(4) Disconnect coaxial connectors W3P6 from A2J6 (18).

(5) Refer to figure 3-15. Remove the 6 sets of mounting hardware (58, 59, 61 and 62) from the electronics board assembly A2.

(6) Remove electronics board assembly A2 from chassis (9).

b. Replacement.

(1) Install electronics board assembly, A2 (19) on chassis (9) using 6 sets of mounting hardware (58, 59, 61, and 62).

(2) Refer to figure 2-2. Connect the four coaxial cables from XMT/RCV assembly A1 (9) to proper connectors on electronics board assembly A2; A1P2/A2J2 (12); A1P3/A2J3 (13); A1P4/A2J4 (16); and A1P5/A2J5 (15).

(3) Connect W2P7 to A2J7 (17).

(4) Connect W3P6 to A2J6 (18).

(5) Connect W1P2 (10) to J1 on the electronics board assembly A2. Make sure that the cable runs are not obstructed, that they do not interfere with any other part or extend beyond the chassis.

3-23. Power Supply Board Assembly A3 Removal and Replacement
(fig. 2-2)

a. Removal.

(1) Disconnect W1P2 from A3J1 (25) on the power supply board assembly, A3 (24).

(2) Disconnect A1P1 from A3J2 (29).

(3) Refer to figure 3-15. Remove the six sets of mounting hardware (63, 64, 66, and 67) holding the power supply board assembly (50) to the chassis (9).

(4) Remove the power supply board assembly.

b. Replacement.

(1) Install power supply board assembly (50) on chassis (9) using six sets of mounting hardware (63, 64, 66, and 67).

(2) Connect A1P1 to A3J2 (28, fig. 2-2) on the power supply board assembly.

(3) Connect W1P2 to A3J1 (24) on the power supply board assembly.

(4) Go to paragraph 3-3 and adjust the required voltage settings as shown on the voltage label (fig. 3-2).

3-24. Terminal Board TB1 Removal and Replacement
(fig. 3-15)

NOTE

Terminal number labels for TB1 (52) are on the protective cover (51). These terminal numbers are to be used when disconnecting and labeling the wires from TB1.

a. Removal.

(1) Tag the wires to TB1.

(2) Remove the four sets of mounting hardware (54, 55, 56 and 57), insulator (53), protective cover, and TB1.

b. Replacement.

(1) Place TB1 (52) into position in the chassis (9).

(2) Connect the wires to proper terminals on TB1 and remove the tags.

(3) Insert the four sets of mounting hardware (56 and 57) through the chassis wall and through the mounting holes of TB1.

(4) Place insulator (53) over the nuts (54).

(5) Position the protective cover (51) on the insulator.

(6) Secure TB1, insulator and the protective cover with four sets of washers (55) and nuts (54).

3-25. MODE Switch S1 Removal and Replacement
(fig. 3-15)

a. Removal.

(1) Disconnect W1P1 (18) from electronics board assembly A2 (19) and fold the cable back out of the way.

(2) Disconnect and tag the wires from S1 (20).

(3) Loosen the two setscrews (21) and pull off the knob (22) from the switch shaft.

(4) Remove mounting hardware (23 and 24), O-ring (25) and pull out the switch S1.

b. Replacement.

(1) Use figures 2-8 and 3-13. Connect jumper wires from switch S1 (M22759/11 16-9) to the terminals as shown below (4, app B).

From	*To*	*Solder Terminal*
A1	A5	A5
A1	A2	A1
A3	A4	A3
B1	B5	B5
B2	B4	B4

(2) Insert switch S1 (20, fig. 3-15) and O-ring (25) with mounting hardware (23 and 24).

(3) Put the knob (22) on the switch shaft and secure with two setscrews (21).

(4) Connect the remaining wires to S1 and remove the tags.

(5) Connect W1P1 (18) to the electronics board assembly A2 (19).

3-26. Filters FL1 or FL2 Removal and Replacement
(fig. 3-15)

a. Removal.

(1) Cut and remove the sleeving from the terminal of FL1 or FL2 (26). Disconnect and tag the wires.

(2) To get inside the filter box remove 8 sets of mounting hardware (27 and 28) and the cover (29). Lay the cover aside.

(3) Cut and remove the sleeving from the terminal of FL1 or FL2. Disconnect and tag the wires.

(4) Remove mounting hardware (30 and 31) and FL1 and FL2.

b. Replacement.

(1) Install FL1 or FL2 (26) with mounting hardware (30 and 31) on the cover (29).

(2) Install a length of sleeving (MIL-I-23053/5, 0.25 dia., type I, black), over the wire leads to FL1 or FL2 (5, app B).

(3) Connect the wires and remove the tags.

(4) Slide the sleeving over the terminals and heatshrink.

(5) Install cover with 8 sets of mounting hardware (27 and 28).

3-27. ON/TRIPPED OFF Circuit Breaker CB1 Removal and Replacement
(fig. 3-15)

a. Removal.

WARNING

Take off the ac power cable assembly from the PWR connector.

CAUTION

Do not strain wires when laying the cover aside.

NOTE

Pay heed to the circuit breaker terminal numbers.

(1) To get inside the filter box remove 8 sets of mounting hardware (27 and 28) and the cover (29). Lay the cover aside.

(2) Remove mounting hardware (32 through 35) and pull CB1 (36) out of the chassis (9) to the extent of the wires.

(3) Cut and remove the sleeving from the four CB1 terminals.

(4) Disconnect and tag the wires.

b. Replacement.

(1) Install a length of sleeving (MIL-I-23053/5, 0.25 dia., type I, black) over the four wires to CB1 (36) (5, Appx B).

(2) Connect the wires and remove the tags.

(3) Slide the sleeving over the CB1 terminals and heatshrink.

(4) Install CB1 with mounting hardware (32 through 35).

(5) Install cover (29) with 8 sets of mounting hardware (27 and 28).

3-28. PWR on Indicator XDS1 Removal and Replacement
(fig. 3-15)

WARNING

Take off the ac power cable assembly from the PWR connector.

CAUTION

Do not strain wires when laying cover aside.

a. Removal.

(1) To get inside the filter box remove the 8 sets of mounting hardware (27 and 28) and the cover (29). Lay the cover aside.

(2) Remove lens (37) with lamp (38).

(3) Loosen mounting hardware (39 and 40) and slide them back over the wires.

(4) Pull XDS1 (41) and its gasket (42) out of the chassis (9) to the extent of the wires.

(5) Cut and remove the sleeving from the XDS1 terminals.

(6) Disconnect and tag the wires.

(7) Remove the mounting hardware (39 and 40) from the leads.

b. Replacement.

(1) Place the gasket (42) on XDS1 (41).

(2) Insert the wires through the mounting hardware, nut (39), washer (40) and the chassis (9) mounting hole for XDS1.

(3) Install a length of sleeving (MIL-I-23053/5, 0.25 dia., type I, black) over each wire (5, Appx B).

(4) Connect the wires and remove the tags.

(5) Slide the sleeving over the terminals and heatshrink.

(6) Install XDS1 with the mounting hardware (39 and 40).

(7) Insert lens (37) and lamp (38).

(8) Install cover (29) with 8 sets of mounting hardware (27 and 28).

3-29. Power Jack J1 Removal and Replacement
(fig. 3-15)

WARNING

Take off the ac power cable assembly from the PWR connector.

CAUTION

Do not strain wires when laying cover aside.

a. Removal.

(1) To get inside the filter box remove 8 sets of mounting hardware (27 and 28) and cover (29). Lay the cover aside.

(2) Remove four sets of mounting hardware (43, 44, and 45) and pull J1 (46) out of the chassis (9) to the extent of the wires.

(3) Cut and remove the sleeving from the J1 terminals.

(4) Disconnect and tag the black wire attached to terminal lug E2 (47).

(5) Disconnect and tag the wires to J1.

(6) Remove gasket (48).

b. Replacement.

(1) Install a length of sleeving (MIL-I-23053/5, 0.25 dia. type I, black) over the black wire attached to terminal lug E2 (47) (5, app B) and heatshrink.

(2) Connect the black wire to terminal lug E2 (47) and remove the tag.

(3) Place the wires to J1 (46) through J1 mounting hole.

(4) Install a length of sleeving. (MIL-I-23053/5, 0.25 dia., type I, black) over each wire to J1.

(5) Install gasket (48) on J1.

(6) Connect the wires and remove the tags.

(7) Slide the sleeving over the J1 terminals and heatshrink.

NOTE

Be sure terminal lug E2 (47) is attached when installing J1.

(8) Install J1 and the terminal lug with mounting hardware (43, 44, and 45).

(9) Install cover (29) with 8 sets of mounting hardware (27 and 28).

3-30. Monitor Jack Cables W2 or W3 Removal and Replacement
(fig. 2-2)

a. Removal.

(1) Disconnect W2P7 from A2J7 (17) or W3P6 from A2J6 (18).

(2) Go to figure 3-15. Unscrew and remove mounting nut and washer holding J3 or J4 to panel.

(3) Remove J3 (63) or J4 (64) from front panel.

(4) After cutting the necessary tie-wraps lift cable W2 (70) or W3 (71) fromn chassis (9).

b. Replacement.

(1) Insert coaxial connector J3 (63) or J4 (64) on the end of the cable W2 (70) or W3 (71) through the right mounting hole J3 or J4 on the front panel from the rear (inside the LR Tester chassis).

(2) Secure the connector J3 or J4 with a washer (72) and mounting nut (73).

(3) Connect the other end of the cable W2 or W3 to the right connector on A2 (A2J6 or A2J7) (fig. 2-2).

(4) Dress the cable(s) in the chassis and cable tie with twine (1, app B).

3-31. Cushion Removal and Replacement
(fig. 2-1)

WARNING

Never use cleaning material in a closed, or poorly aired work area or near a fire or open flame. Avoid touching skin with cleaning fluid.

a. Removal.

(1) Using a knife, scrape off the damaged cushion in compartment (1 or 5).

(2) Remove any remaining cushion material and gum with solvent, Uresolve Plus (27908), (6, app B).

(3) Clean the area for the cushion seating with isopropyl alcohol, TT-I-735, (7, app B).

b. Replacement.

(1) Cut the cushion material, (silicon sponge rubber, self adhering, black, R-10470, medium grade 0.12 in. thick), to the required size (8, app B).

(2) Peel off the paper backing, seat and press the cushion into the compartment (1 or 5).

3-32. EMI Gasket Removal and Replacement
(fig. 3-16)

a. Removal.

(1) Using a knife, scrape off the damaged gasket.

(2) Remove any remaining gasket material and adhesive with MEK, TT-M-261 (9, app B) and air dry.

b. Replacement.

(1) Apply a thin coat of adhesive (EC 1357 (04963)), (10, app B), to the surface area where the gasket is to be laid.

NOTE

Make sure that the screw holes in the gasket aline with those in the base.

(2) Install the gasket and let cure for 12 hours.

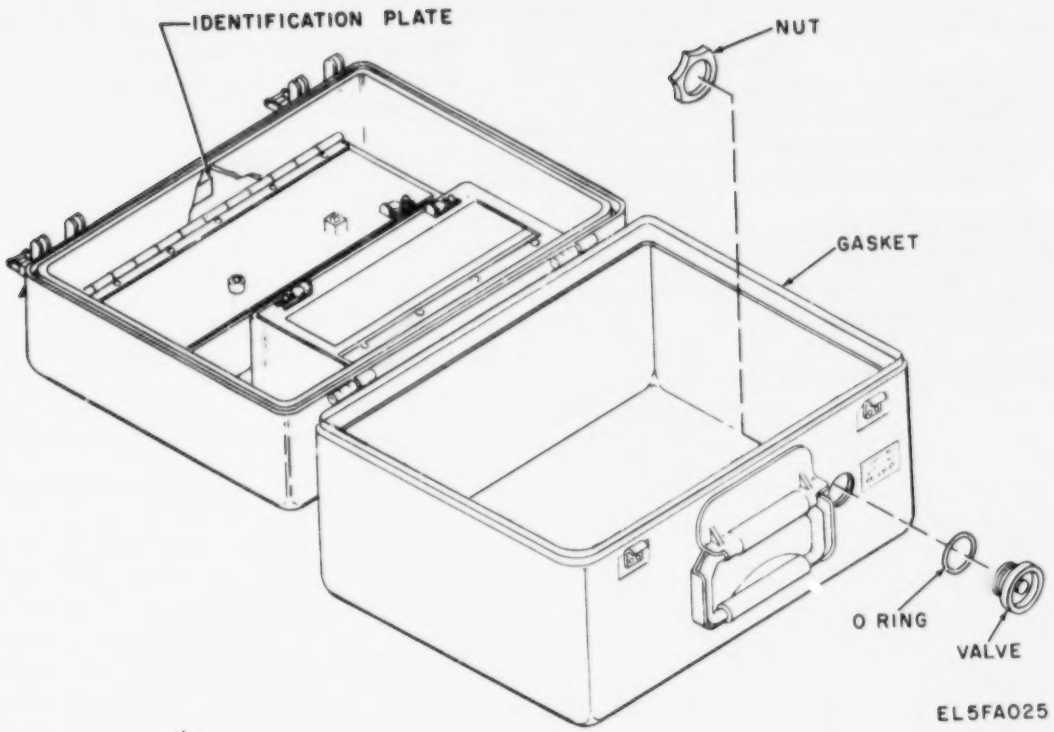


Figure 3-16. Air Pressure Relief Valve and EMI Gasket Location Diagram.

3-33. Air Pressure Relief Valve Removal and Replacement
(fig. 3-16)

a. Removal.

(1) Loosen the nut and take if off.

(2) Pull out the value from the hole in the base.

(3) If the O-ring does not come off witht he value, take it off.

b. Replacement.

(1) Place the O-ring insdie the collar of the valve.

(2) Put the valve into the hole in the base.

(3) Screw the nut onto the valve barrel.

3-34. Optical Shroud and Window Assembly Removal and Replacement
(fig. 3-17)

a. Removal.

(1) Use an orangewood stick to gently pry and lift off the optical shroud. Gently scrape away any leftover rubber and glue.

WARNING

Never use cleaning material in a closed or poorly aired work area or near a fire or open flame. Avoid touching skin with cleaning fluid.

(2) If the window is to be removed, go to step (4).

(3) Use care to avoid splatter on the widow. Use naphtha and soft tissue to clean the contact surface on the panel for the optical shroud (11, app B).

(4) Remove the mounting screws for the window assembly. Lift out the screws and the window assembly. Perform step (3) above and clean the mounting surface.

b. Replacement.

(1) If only the optical shroud is to be replaced, go to step (2). Set the window assembly in the window port (transmitter and/or receiver port) alining the holes in the window assembly with the holes in

the panel. Use four screws and secure the window assembly to the panel.

(2) Peel off the paper backing which protects the gum on the back surface of the optical shroud. Aline the shroud with the windows and the screw slot on the panel. Lay the sticky side down on the panel. Press down on all of the face of the shroud firmly to make sure it sticks to the panel completely.

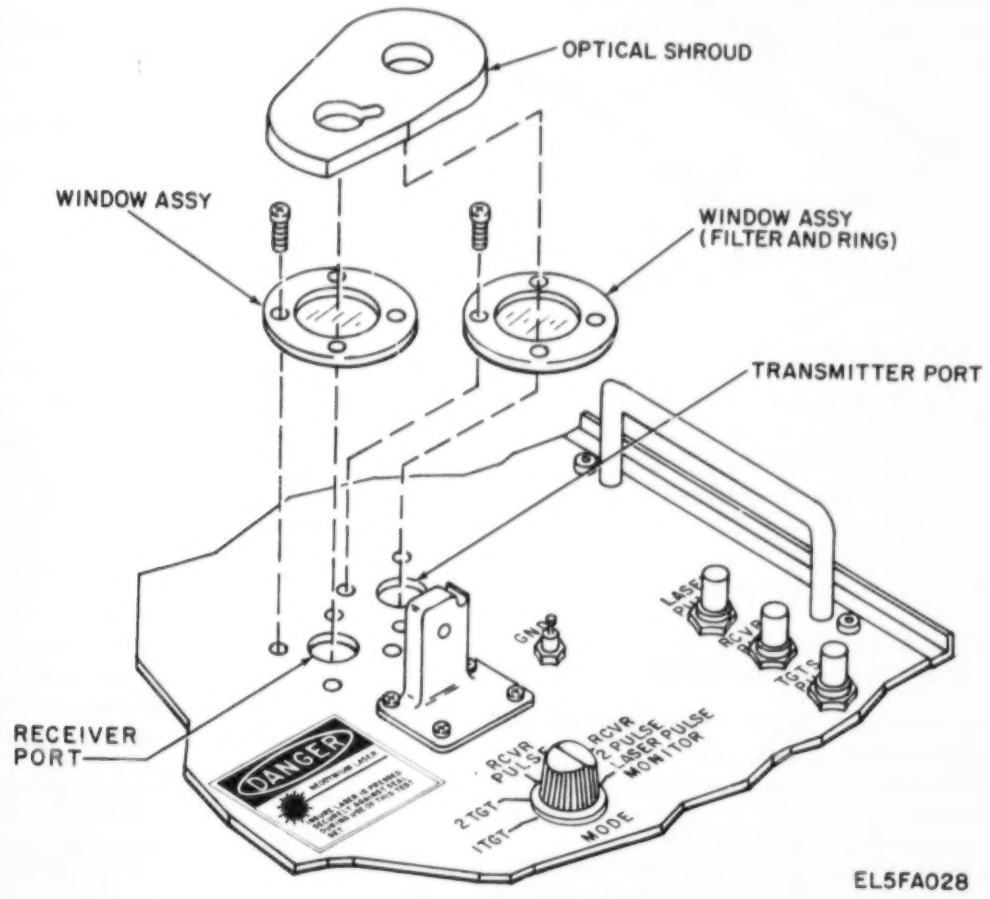


Figure 3-17. Optical Shroud and Window Assembly Location Diagram.

3-35. Handle Removal and Replacement
(fig. 3-15)

a. Removal. Remove the two screws (75) and the handle (74).

b. Replacement. Secure the handle (74) with two screws (75).

3-36. Bracket Mount Removal and Replacement
(fig. 3-15)

a. Removal. Remove the four sets of mounting hardware (77, 78, 79, and 80) and the mount (76).

b. Replacement. Secure the bracket mount (76) with four sets of mounting hardware (77, 78, 79, and 80).

3-37. Ground Terminal E1 Removal and Replacement
(fig. 3-15)

a. Removal. Remove the mounting hardware (82, 83, and 84) and the terminal E1 (81).

b. Replacement. Secure the terminal E1 (81) with the mounting hardware (82, 83, and 84).

3-38. Printed Circuit Board Mounting Bushing Removal and Replacement

(fig. 3-18)

a. Removal.

(1) Remove the A2 assembly (para 3-22) or the A3 assembly (para 3-23).

(2) Use a very sharp knife to cut away the old bonding material holding the mounting bushing to the printed circuit board. Pull the bushing out of its hole.

(3) Carefully scrape away residue of the old bonding material.

b. Replacement.

WARNING

Never use cleaning material in a closed or poorly aired work area or near a fire or open flame. Avoid touching skin with cleaning fluid.

(1) Use naphtha and soft tissue to clean the bushing contact surface of the printed circuit board (11, app B).

NOTE

The two parts sealant used for bonding after mixing does not fully harden. It will stay partially soft. There is no solvent for part one (base). Xylene is the solvent for part two (accelerator).

(2) Mix the two parts sealant bound (12, app B). Follow the rules on the tube containers it comes in.

(3) Apply the bond mixture to the bushing and the printed circuit board hole.

(4) Insert the bushing into the hole flush with the printed circuit board.

(5) Air cure for at least 24 hours. At that time the bond will be tacky and the board can be put on the chassis. The full air cure takes 48 hours which allows normal handling. Install the A2 board (para 3-22) or the A3 board (para 3-23).

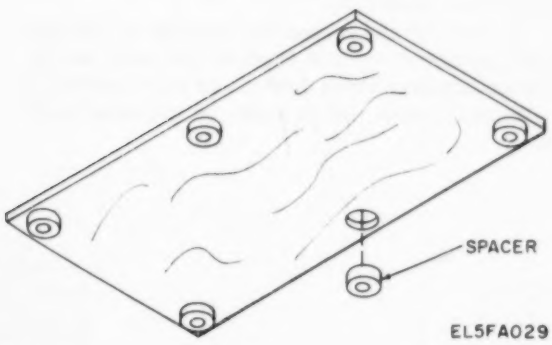


Figure 3-18. Printed Circuit Board Mounting Bushing Location

3-39. Alinement Bracket Assembly Parts Removal and Replacement

(fig. 3-19)

a. Removal.

(1) All parts of this assembly, except the spring pin, may be removed from each other by unscrewing the holding screw, washers and nuts. The disassembly is shown in figure 3-19.

(2) Use a small hammer and a 1/16 inch drive pin punch to drive out the spring far enough out of the mounting stand to be grasped by pliers. Pull the spring pin all the way out of the mounting stand.

b. Replacement.

(1) Put the spring pin into its hole in the mounting stand and gently tap it in until it is flush with the mounting stand wall. To test it, put the mounting stand for correct fit on the bracket mount (10, fig. 2-1).

(2) Test the stow lock position to ensure that the arm is free to rotate.

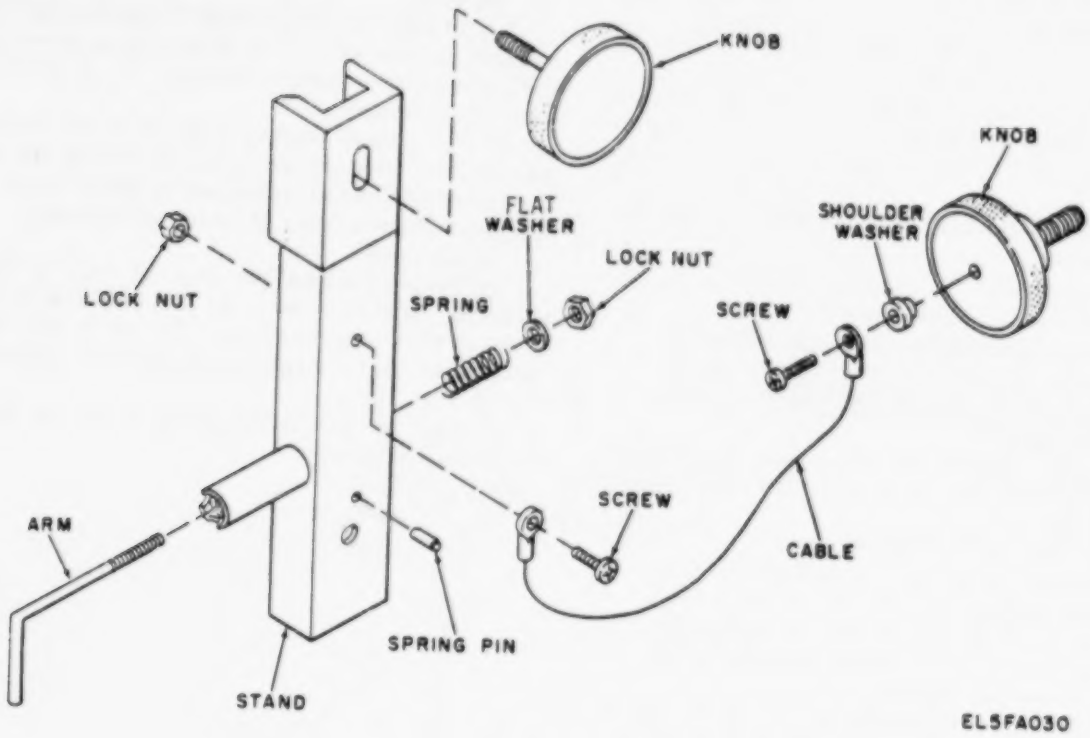


Figure 3-19. Alinement Bracket Assembly Exploded View.

3-40. Test Set Identification Plate Removal and Replacement
(fig. 3-16)

a. Removal.

(1) Record any identification data still existing on the identification plate, particularly the equipment serial number. The data required is shown in figure 3-20.

(2) Carefully scrape off the identification plate. Avoid scratching the paint.

b. Replacement.

WARNING

Never use cleaning material in a closed or poorly aired work area or near a fire or open flame. Avoid touching skin with cleaning fluid.

(1) Carefully scrape away any gum residue of the old identification plate contact surface on the cover.

(2) Use naphtha and soft tissue to clean the contact surface (11, app B).

(3) Prepare a new identification plate with data as shown in figure 3-20.

(4) Peel off the protective backing on the new plate. Lay the sticky side down on the cover (see fig. 3-16 for location). Press down on all of the surface of the plate to make sure it sticks to the cover completely.

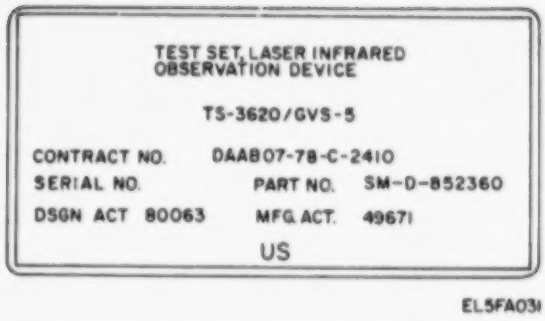


Figure 3-20. Test Set Identification Plate.

3-41. Adapter Cable Assembly Servicing (fig. 3-21)

CAUTION

The capacitor (27) in the ACA will hold an electrical charge a long time after the power has been shut off. Discharge the capacitor before handling it.

The following paragraphs have rules for the removal and the replacement of faulty ACA parts. After a replacement, go to paragraph 3-16 for retest of the ACA.

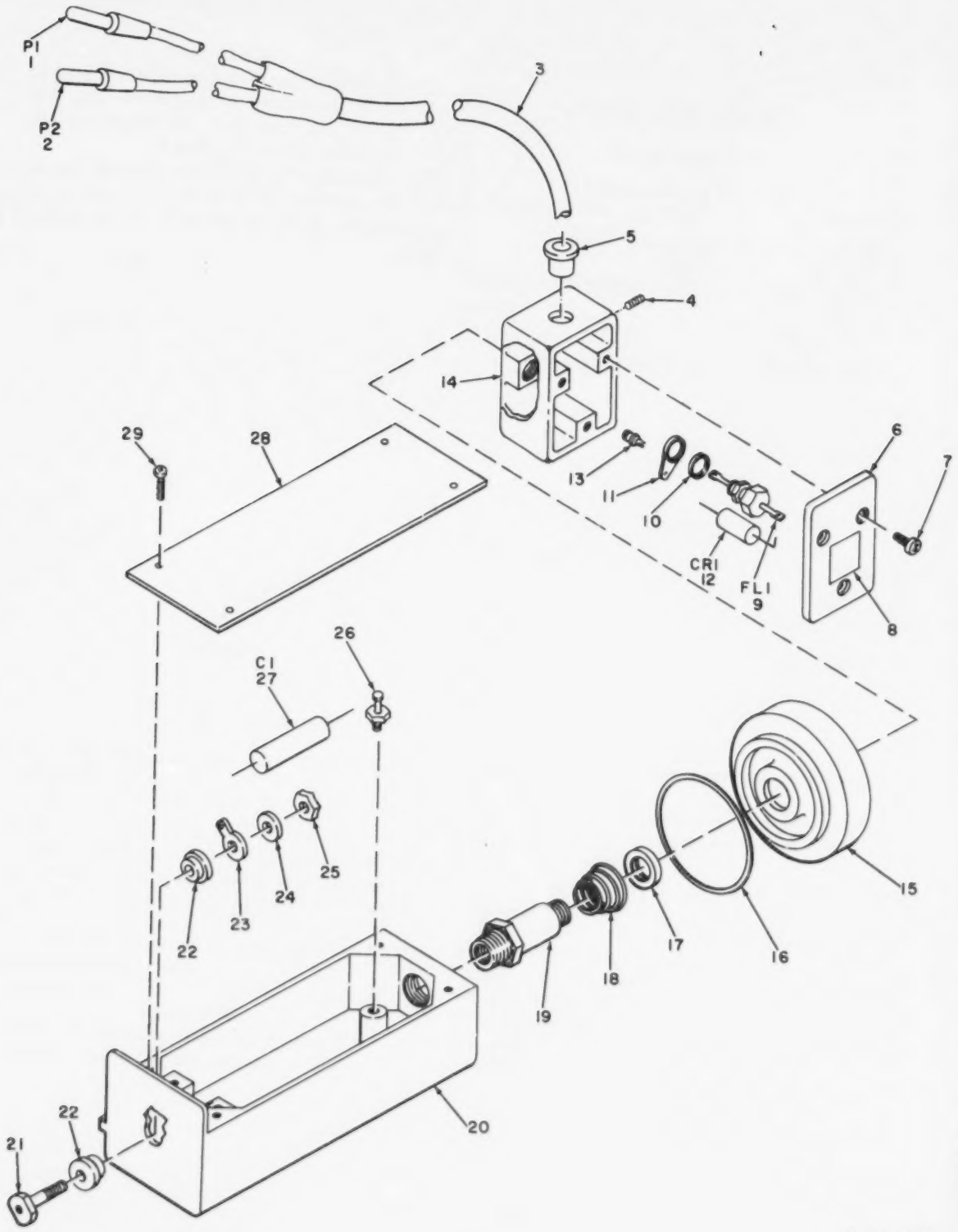


Figure 3-21. Adapter Cable Assembly Exploded View.

1. Red connector plug P1
2. Black connector plug P2
3. Cable
4. Setscrew
5. Strain relief bushing
6. Cable support cover
7. Screw
8. Warning label
9. EMI filter FL1
10. Lockwasher
11. Insulated terminal E2
12. Diode CR1
13. Terminal E3
14. Cable support box
15. Cap
16. O-Ring
17. Shaft seal
18. Spring
19. Shaft
20. Chassis
21. Output terminal E4
22. Insulated bushing
23. Lug terminal
24. Lockwasher
25. Nut
26. Terminal E1
27. Capacitor C1
28. Chassis cover
29. Screw

Figure 3-21. Adapter Cable Assembly Exploded View.

3-42. ACA Filter FL1 Removal and Replacement (fig. 3-21)

a. Removal.

(1) Remove three screws (7) and cable support cover (6).

(2) Desolder and remove the wire to the filter (9).

(3) Tag the wire.

(4) Unscrew and remove the filter and its internal tooth lockwasher (10).

(5) If insulated terminal E2 (11) is to be taken out, peel away the plastic coating, desolder and take off the wire to the filter. Tag the wire. Take out the terminal.

b. Replacement.

(1) Apply sealing compound to the threads of the filter FL1 (9) (13, app B).

(2) Use a torque wrench to put in the internal tooth lockwasher (10) and the filter FL1, 3.0 to 5.0 inch-pounds.

(3) Take off the tag from the wire. Connect the wire to the filter.

(4) If insulated terminal E2 (11) is to be replaced, take off the tag from the wire. Put in the terminal. Connect the wire to the terminal. Apply from 0.02 to 0.08 inch thickness of staking compound on all the conductors joined (14, app B).

(5) Apply sealing compound to the three screws (7).

(6) Put on the cable support cover (6) and secure by the three screws.

3-43. ACA Diode CR1 Removal and Replacement (fig. 3-21)

a. Removal.

(1) Remove three screws (7) and the cable support cover (6).

(2) Peel away the plastic coating at the terminals E2 (11) and E3 (13) with diode CR1 (12).

(3) Desolder the diode wires and remove the diode. Note that the cathode end (with bar on diode body) was joined to terminal E2.

b. Replacement.

(1) Wrap the diode CR1 (12) wire cathode end (bar) to terminal E2 (11), and the anode end (plain) wire to terminal E3 (13).

(2) Use a heatsink and solder connect the diode to the terminals.

(3) At terminals E2 and E3 apply from 0.02 to 0.08 inch thickness of staking compound on all the conductors joined (14, app B).

(4) Apply sealing compound to the three screws (7) (13, app B).

(5) Put on the cable support cover (6) and secure by the three screws.

3-44. ACA Terminal E1 Removal and Replacement (fig. 3-21)

a. Removal.

(1) Remove the four screws (29) and the cover (28).

(2) Desolder and remove the capacitor (27) wire from the terminal (26).

(3) Unscrew and remove the terminal.

b. Replacement.

(1) Screw in the terminal E1 (26).

(2) Wrap the capacitor C1 (27) wire on to the terminal. Solder the wire to the terminal.

(3) Apply sealing compound to the four screws (29), (13, app B).

(4) Put on the cover (28) and secure by the four screws.

3-45. ACA Capacitor C1 Removal and Replacement (fig. 3-21)

a. Removal.

(1) Remove the four screws (29) and the cover (28).

(2) Cut away the sleeve on the wire from the capacitor C1 (27) positive (+) end.

(3) Desolder and remove the capacitor wires from terminal E4 (21) and terminal E1 (26). Tag the other wire joined to E4 (comes from the filter FL1 (9) through the shaft (19)). With a sharp knife cut the bond holding capacitor C1 to the chassis (20). Scrape out any leftover bond material.

b. Replacement.

(1) Put a piece of insulated tubing on the positive (+) end wire of capacitor C1 (27) (15, app B). Cut it to a length just enough to go to the output terminal E4 (21) when the capacitor is midway between E4 and terminal E1 (26).

(2) Connect the capacitor positive (+) end wire together with the tagged wire from filter FL1 (9) to terminal E4.

(3) Connect the capacitor negative (plain) end wire to terminal E1.

(4) Bond the capacitor to the chassis (20) with staking compound (14, app B).

(5) Apply sealing compound to the four screws (29) (13, app B).

(6) Put on the cover (28) and secure by the four screws.

3-46. ACA Cable Removal and Replacement
(fig. 3-21)

a. Removal.

(1) Remove three screws (7) and cable support cover (6).

(2) Peel away the plastic coating at the terminals E2 (11) and E3 (13) with diode CR1 (12) and FL1 (9).

(3) Use the heatsink when work is done on the diode. Desolder and take off the two cable (3) wires from CR1 and FL1.

(4) Squeeze the strain relief bushing (5) and gently pull the cable (3) from the cable support box (14) through the bushing.

b. Replacement.

(1) Thread the cable (3) through the strain relief bushing (5).

(2) Connect the cable positive (+) wire to filter FL1 (9) terminal. Find the positive wire running from the red connector P1 (1) by an ohmmeter continuity check.

(3) Clamp a heatsink onto the wire from terminal E2 (11) to CR1 (12).

(4) Connect the cable negative (−) wire to terminal E2.

(5) At terminals E2 and E3 (23) apply from 0.02 to 0.08 inch thickness of staking compound on all the conductors joined (14, app B).

(6) Seat the strain relief bushing (5) in the cable support box (14).

(7) Apply sealing compound to the three screws (7) (13, app B).

(8) Put the cable support cover (6) on the support box and secure by the three screws.

3-47. ACA O-Ring Removal and Replacement
(fig. 3-21)

a. Removal. Work the O-ring (16) out of its slot in the cap (15).

b. Replacement.

(1) Use soft tissue and clean out the slot for the O-ring (16) in the cap (15).

(2) Apply a thin film of silicon compound to the O-ring. Wipe the O-ring nearly dry with a clean lintless cloth (16, app B).

(3) Work the O-ring into its slot in the cap.

APPENDIX A
REFERENCES

The following list of references are applicable to the LR Test Set.

1. General

AR 40-46	Control of Health Hazards from Lasers and Other High Intensity Optical Sources.
AR 735-11-2	Reporting of Item and Package Discrepancies.
DA Pam 25-30	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
TB MED 279	Control of Hazards to Health from Laser Radiation.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

2. Laser Infrared Observation Device AN/GVS-5

TM 11-5860-201-10	Operator's Manual: Laser Infrared Observation Set AN/GVS-5 (NSN 5860-01-062-3543).
TM 11-5860-210-20	Organizational Maintenance Manual: Laser Infrared Observation Set AN/GVS-5 (NSN 5860-01-062-3543).
TM 11-5860-201-30	Direct Support Maintenance Manual: Laser Infrared Observation Device AN/GVS-5 (NSN 5860-01-062-3543).

3. Test Set, Laser Infrared Observation Device TS-3620/GVS-5

TM 11-6625-2684-12	Operator and Organizational Maintenance Manual: Test Set, Laser Infrared Observation Device TS-3620/GVS-5 (NSN 5860-01-052-9477).

APPENDIX B

EXPENDABLE SUPPLIES AND MATERIAL LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the LR Test Set. These items are authorized to you by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

B-2. Explanation of Columns

a. Column 1—Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, app D").

b. Column 2—Level. This column identifies the lowest level of maintenance that requires the listed item.

F—Direct Support Maintenance

c. Column 3—National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4—Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5—Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

B-3. Special Information

National stock numbers (NSN's) that are missing from section II have been applied for and will be added to this technical manual by future Change/Revision when they are entered in the Army Master Data File (AMDF). Until the NSN's are established and published, submit exception requisitions to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MM, Fort Monmouth, NJ 07703 for the part required to support your equipment.

Section II. Expendable Supplies and Materials List

(1) Item No.	(2) Level	(3) National Stock Number	(4) Description Part No. and FSCM	(5) Unit of meas
1	F	4020-00-542-2772	Twine, Impregnated, Type P, Unwaxed Class 3, MIL-T-713	rl
2	F	—	Silicon Compound MIL-S-22473. (81349)	pt
3	F	5340-01-020-6326	Cable Clamp MS25281R4. (96906)	ea
4	F	6145-01-006-2844	Jumper Wire MS22759/11-16-9, MIL-W-227690. (81349)	ft
5	F	—	Shrink Sleeving MIL-I-23053/5, Type I 0.25 in. dia black. (81349)	ft
6	F	3655-00-792-1565	Solvent (Uresolve plus). (27908)	pt
7	F	6850-00-404-9386	Isopropyl Alcohol, TT-I-735. (80058)	pt

(1) Item No.	(2) Level	(3) National Stock Number	(4) Description	(5) Unit of meas
8	F	9320-01-056-0957	Silicone Sponge Rubber Med Grade, 0.12 thk, R-10470. (80058)	sh
9	F	6810-00-264-8983	Methylethyl Ketone (MEK), TT-M-261 (80058)	pt
10	F	8040-00-174-1799	Adhesive EC1257. (04963)	pt
11	F		Naphtha, Varnish & Paint Makers Solvent (VMP)—Commercial.	
12	F	8030-00-264-4385	Sealant, Two Parts SM-A-852130. (04963)	tb
13	F	—	Sealing Compound, Grace C MIL-S-22473. (81349)	rb
14	F	—	Staking Compound SM-B-739574. (80063)	tb
15	F	5970-00-051-4554	Insulating Tubing, No. 20 MIL-I-22129. (81349)	ft
16	F	—	Primer, Grade N, Form R MIL-S-22473.	pt

INDEX

	Paragraph or Table	Pages
ACA:		
Capacitor C1 removal and replacement	3-45	3-35
Diode CR1 removal and replacement	3-43	3-35
Filter FL1 removal and replacement	3-42	3-35
Functional Analysis	2-14	3-6
O-ring removal and replacement	3-47	3-36
Terminal E1 removal and replacement	3-44	3-35
Test	3-16	3-15
Adapter cable assembly (ACA) removal and replacement	3-41	3-33
Adapter cable assembly function analysis	2-14	2-6
Air pressure relief valve removal and replacement	3-33	3-29
Alinement bracket part removal and replacement	3-39	3-31
Analysis of LR Tester, general	2-3	2-1
Bracket mount removal and replacement	3-36	3-30
Calibration	1-5	1-3
Circuit functions analysis	2-6	2-5
Corrective action	T 3-3	3-16
Correction action, Troubleshooting	3-17	3-17
Cushion removal and replacement	3-31	3-28
Data, tabulated	1-8	1-3
Description, LR Test Set	1-7	1-3
Destruction of Army materiel to prevent enemy use	1-4	1-3
Electronics board assembly A2:		
Functional analysis	2-9	2-6
One-shot pulse check	3-6	3-5
Operational analysis	2-18	2-7
Removal and replacement	3-22	3-25
Filter:		
FL1 ACA removal and replacement	3-42	3-35
FL2 ACA removal and replacement	3-42	3-35
Forms and records	1-3	1-3
Function indicators and jacks analysis	2-5	2-5
Gasket, EMI removal and replacement	3-32	3-28
Ground Terminal E1 removal and replacement	3-37	3-30
Handle removal and replacement	3-35	3-30
Indexes of publications	1-2	1-3
Indicator, PWR ON, removal and replacement	3-28	3-27
Interface with LR	2-2	2-1
With equipment, general	2-1	2-1
Introduction, Direct Support maintenance instructions	3-1	3-1
Troubleshooting	3-12	3-12
Laser output display check, LR Test Set	3-9	3-10
Indicators function analysis	2-12	2-6
Low output indicator removal and replacement	3-21	3-25
LR interface with equipment	2-2	2-1
LR Tester, analysis, general	2-3	2-1
LR Test Set:		
Laser output display check	3-9	3-10
Receiver pulse display check	3-7	3-6
Target pulse display check	3-8	3-9
Malfunction, test	T 3-3	3-17
Measurement:		
Continuity, mode switch S1/Plug W1P1	3-10	3-11
Power supply board assembly A3 voltage	3-3	3-1
Voltage and resistance	3-2	3-1

	Paragraph or Table	Pages
Mode:		
Analysis	2-4	2-5
Switch analysis	2-4	2-5
Plug W1P1 continuity measurements	3-10	3-11
Removal and replacement	3-25	3-26
S1, Function and analysis	2-10	2-6
S1, Operation analysis	2-19	2-8
Monitor:		
Jack cable W2 removal and replacement	3-30	3-28
W3 removal and replacement	3-30	3-28
Jacks functional analysis	2-13	2-6
Normal indicator removal and replacement	3-21	3-25
One-shot output pulse check, electronics board assembly A2	3-6	3-5
ON/TRIPPED OFF circuit breaker CB1 removal and replacement	3-27	3-27
Operational process analysis	2-15	2-6
Optical shroud and window removal and replacement	3-34	3-29
Oscillator negative pulse check display	3-4	3-2
Parts removal and replacement	3-19	3-22
Pass/Fail Test:		
Preparation, troubleshooting	3-14	3-13
Troubleshooting	3-15	3-14
Power:		
Input circuit operational analysis	2-16	2-7
Jack, removal and replacement	3-29	3-27
Receiver	2-17	2-7
Supply board assembly A3:		
Functional analysis	2-7	2-5
Operational analysis	2-17	2-7
Removal and replacement	3-23	3-26
Voltage lable measurements	3-3	3-1
Table	T 3-1	3-1
Transmitter	2-17	2-7
Preparation, Pass/Fail Test, troubleshooting	3-14	3-13
Printed circuit board bushing:		
Removal and replacement	3-38	3-31
Procedure, troubleshooting table	T 3-3	3-17
Publications, index of	1-2	1-1
Pulse check:		
One-shot output, electronics board assembly A2	3-6	3-5
Oscillator negative, electronics board assembly A2	3-4	3-2
Two-targets, one-shot pulse, electronics board assembly A2	3-5	3-4
PWR ON indicator removal and replacement	3-20	3-25
Receiver:		
Power Supply	2-17	2-7
Pulse display check, LR Test Set	3-7	3-6
Records, forms and	1-3	1-3
Removal and replacement:		
ACA cable	3-46	3-36
Capacitor C1	3-45	3-35
Diode CR1	3-43	3-35
Filter FL1	3-42	3-35
O-ring	3-47	3-36
Shaft	3-48	3-
Terminal E1	3-44	3-35
Adapter cable assembly	3-41	3-33
Air pressure relief valve	3-33	3-29
Alinement bracket assembly part	3-39	3-31
Bracket mount	3-36	3-30
Cushion	3-31	3-28
Electronics board assembly A2	3-22	3-25
EMI gasket	3-32	3-28

	Paragraph or Table	Pages
Filter FL1	3-26	3-26
Filter FL2	3-26	3-26
Ground terminal E1	3-37	3-30
Handle, LR Tester	3-35	3-30
Low output indicator	3-21	3-25
Mode switch S1	3-25	3-26
Monitor jack cable W2	3-30	3-28
Monitor jack cable W3	3-40	3-32
Normal indicator	3-21	3-25
ON/TRIPPED OFF circuit breaker CB1	3-27	3-27
Parts	3-19	3-22
Power jack	3-29	3-27
Power supply board assembly A2	3-23	3-26
Printed circuit board bushing	3-38	3-31
PWR ON indicator	3-28	3-27
Terminal board TB1	3-24	3-26
Test set identification plate	3-40	3-32
Transformer T1	3-20	3-25
Reporting equipment improvement recommendations	1-6	1-3
Reset switch S2 functional analysis	2-11	2-6
Resistance measurements, voltage and	3-2	3-1
Scope (of technical manual)	1-1	1-1
Shaft, removal and replacement, ACA	3-48	3-
Shutdown after troubleshooting	3-18	3-
Special tools and test equipment	T 3-2	3-12
Tabulated data	1-8	1-3
Target pulse:		
Display cneck, LR Test Set	3-8	3-9
Terminal:		
Board TB1 removal and replacement	3-24	3-26
E1, ACA, removal and replacement	3-44	3-35
Test:		
Equipment and Tools	3-11	3-12
Special tools and test equipment	T 3-2	3-12
Malfunction	T 3-3	3-17
Removal and replacement	3-40	3-32
Tools and test equipment	3-11	3-12
Transformer T1 removal and replacement	3-20	3-25
Transmit/Receive		
Assembly A1 functional analysis	2-8	2-5
A1A1 operational analysis	2-20	2-9
Transmitter power supply	2-17	2-7
Troubleshooting:		
Corrective action	3-17	3-16
Introduction	3-12	3-12
Pass/Fail test	3-15	3-14
Preparation	3-14	3-13
Procedure table	T 3-3	3-17
Shutdown, after	3-18	3-22
Visual Inspection	3-13	3-12
Two-targets, one-shot output pulse:		
Check, electronics board assembly A2	3-5	3-4
Visual inspection, troubleshooting	3-13	3-12
Voltage and resistance measurements	3-2	3-1
Power supply board	T 3-1	3-1
Window removal and replacement	3-34	3-29

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703

DATE 10 July 1975

PUBLICATION NUMBER	DATE	TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/[illegible]-76

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of [illegible] knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. + 24 VDC is the input voltage.

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
SSG I. M. DeSpiritof 999-1776

SIGN HERE:
SSG I. M. DeSpiritof

DA FORM 1 AUG 74 2028-2 (TEST)

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG DOTTED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2684-30	1 Aug 79	Test Set, Lasar Infrared Observation Device TS-3620/GVS-5

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG DOTTED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

FOLD BACK

TEAR ALONG DOTTED LINE

REVERSE OF DA FORM 2028-2

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2684-30	1 Aug 79	Test Set, Lasar Infrared Observation Device TS-3620/GVS-5

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG DOTTED LINE

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DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

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REVERSE OF DA FORM 2028-2

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

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REVERSE OF DA FORM 2028-2

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:
J. C. PENNINGTON
Major General, United States Army
The Adjutant General

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TOAD (14)
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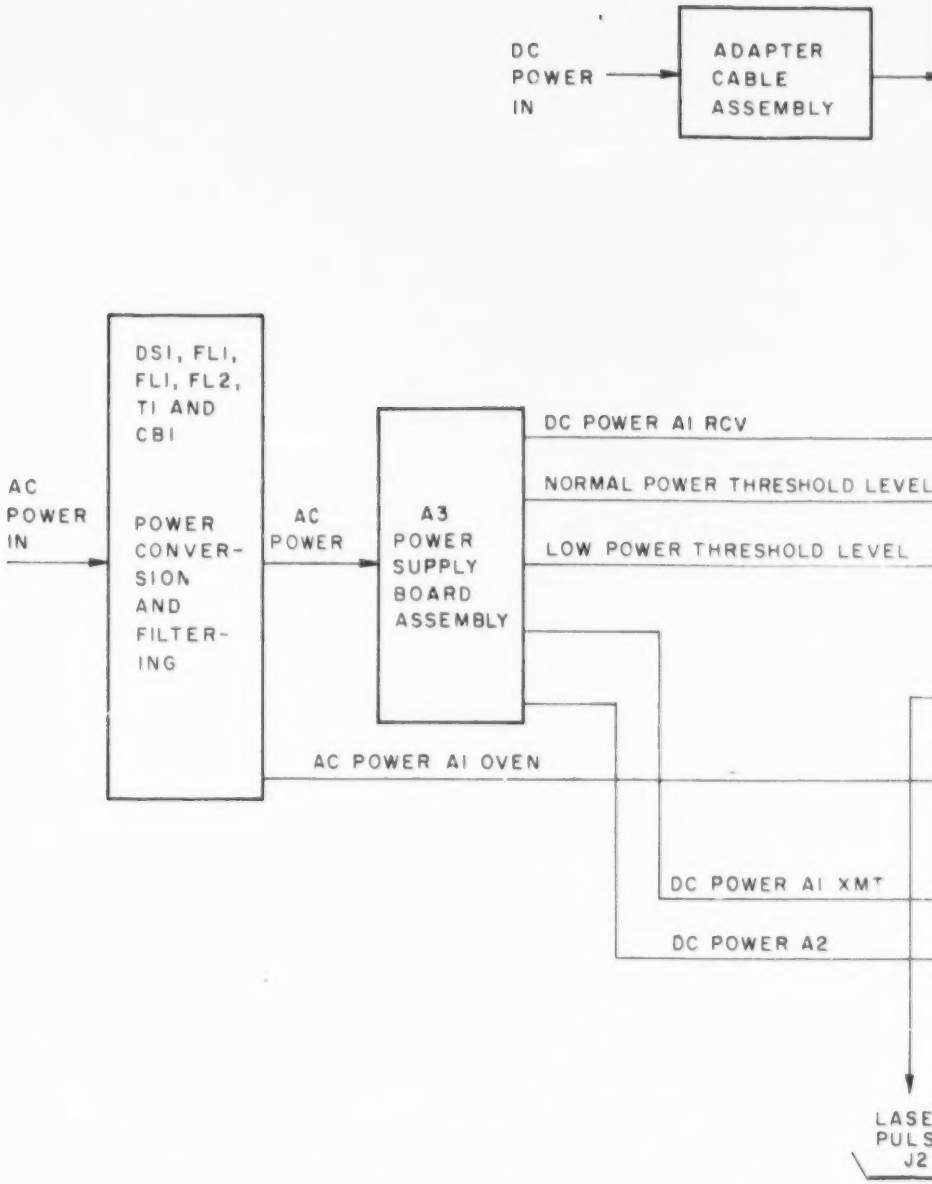
USA Dep (1)
Sig Sec USA Dep (1)
Ft Richardson (CERCOM OFC) (2)
Units org under fol TOE:
29-207 (2)
29-610 (2)

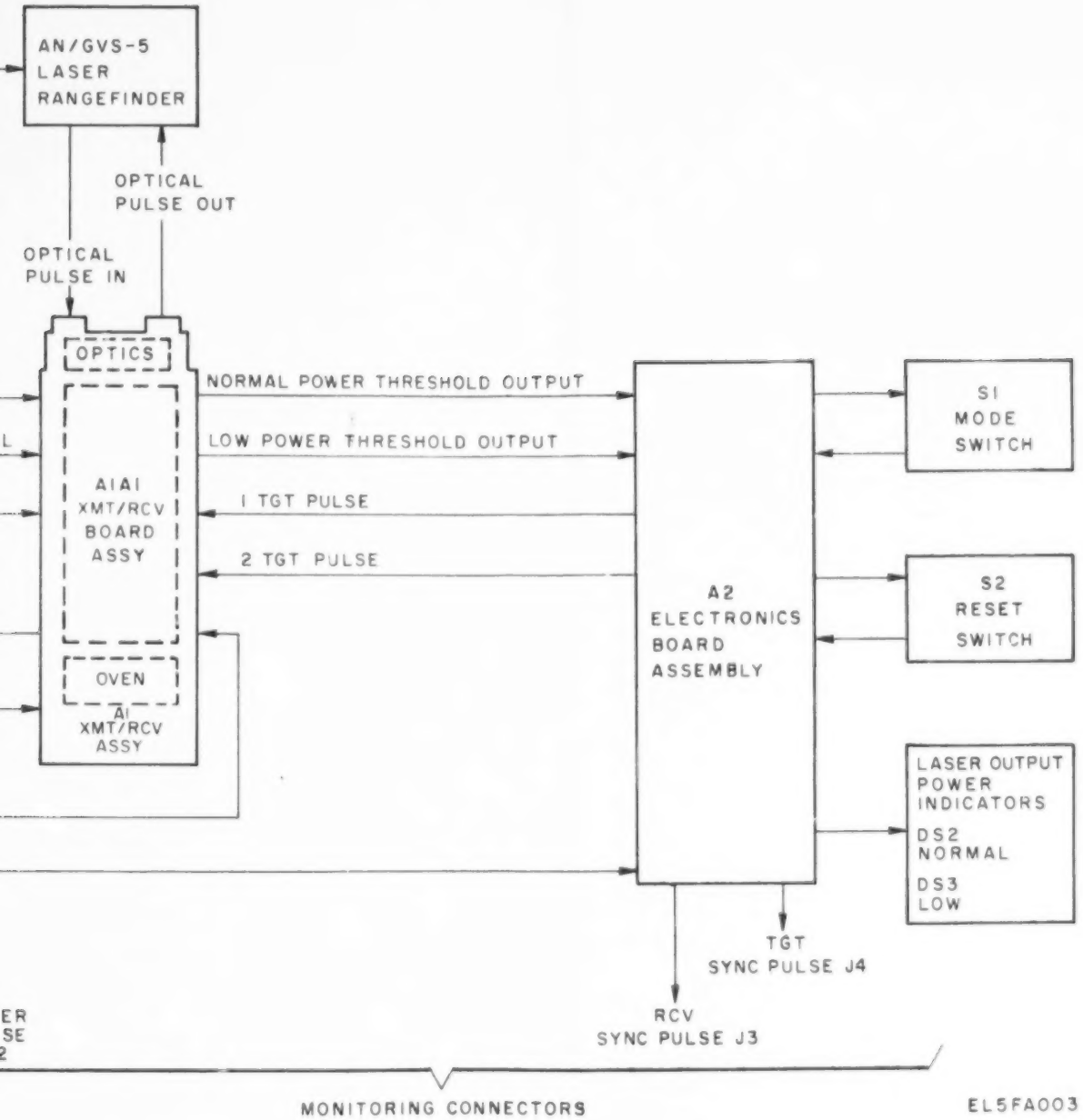
NG: None.

USAR: None.

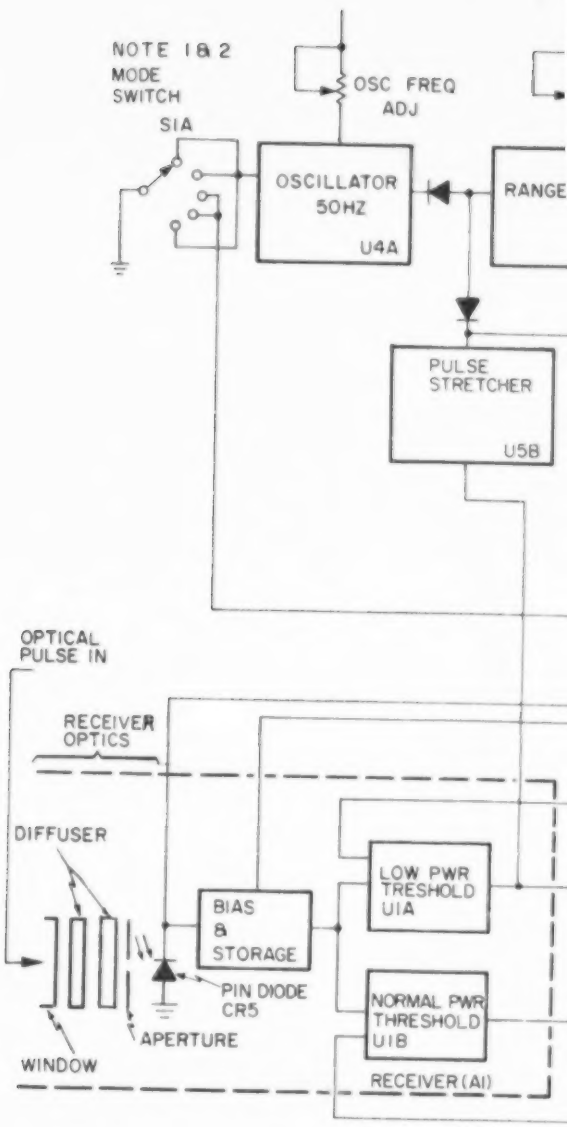
For explanation of abbreviations used see, AR 310-50.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1990 O - 261-872 (21054)


DC
POWER
IN
ADAPTER
CABLE
ASSEMBLY
AC
POWER
IN
DSI, FLI,
FLI, FL2,
TI AND
CBI
POWER
CONVER-
SION
AND
FILTER-
ING
AC
POWER
A3
POWER
SUPPLY
BOARD
ASSEMBLY
DC POWER AI RCV
NORMAL POWER THRESHOLD LEVEL
LOW POWER THRESHOLD LEVEL
AC POWER AI OVEN
DC POWER AI XMT
DC POWER A2
LASE
PULS
J2

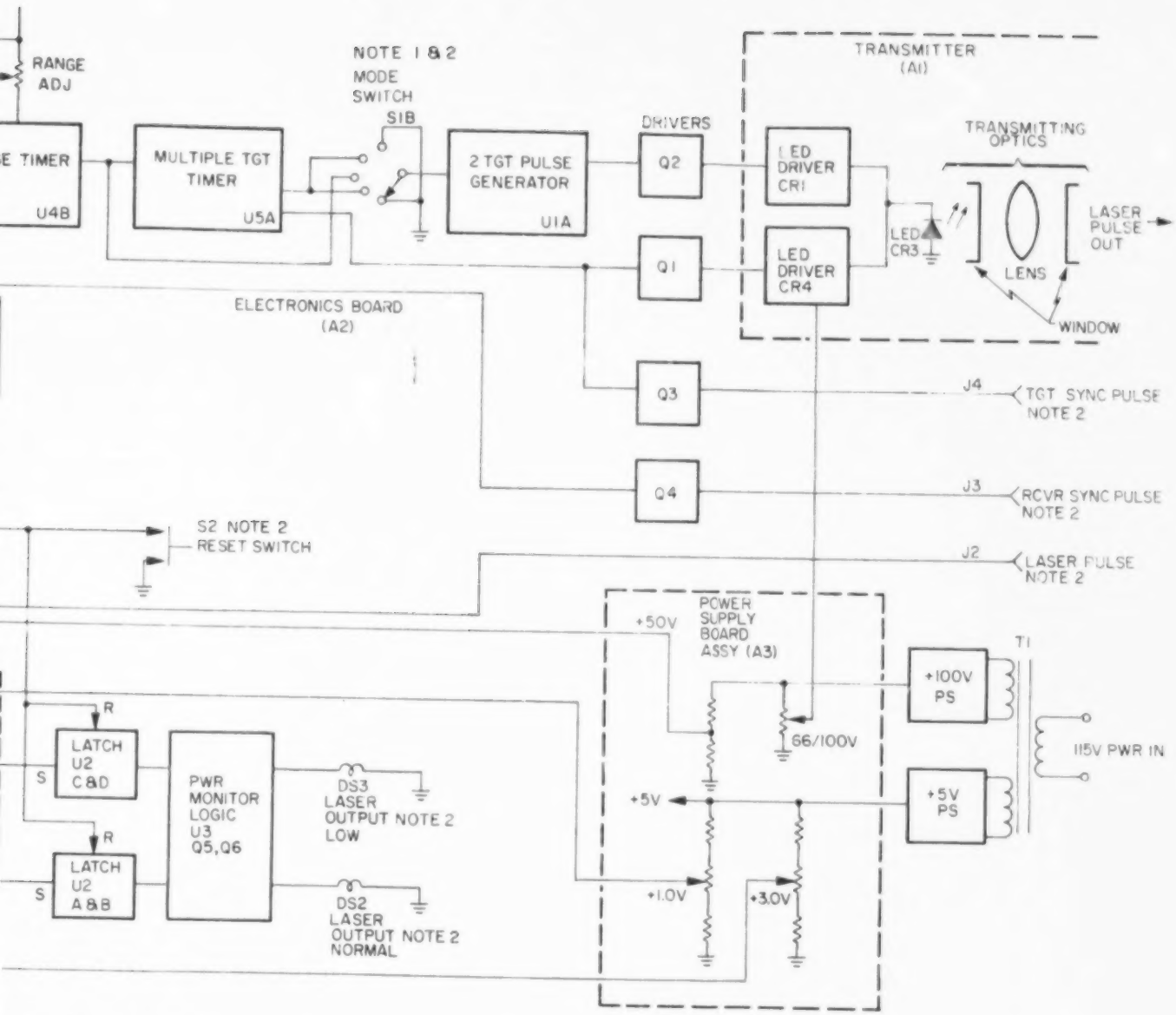


FO-1 Interface Block Diagram



NOTE:

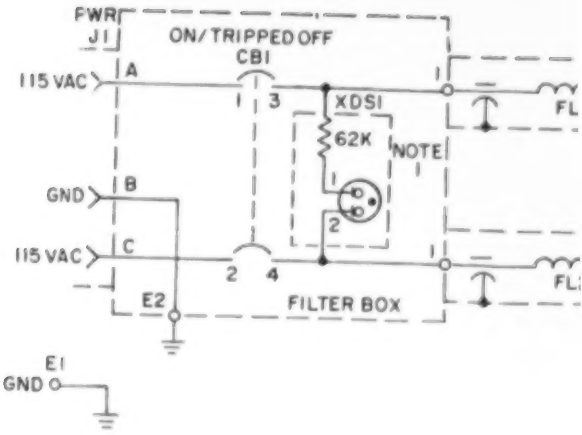
1. MODE SWITCH S1 POSITIONS FRONT PANEL
   POS 1 - 1 TGT
   POS 2 - 2 TGT
   POS 3 - RCVR 1 PULSE
   POS 4 - RCVR 2 PULSE
   POS 5 - LASER PULSE MONITOR
2. FRONT PANEL
3. UNLESS
   RESIST
   CAPACI
4. PARTIA
   FOR CO
   SUBASS

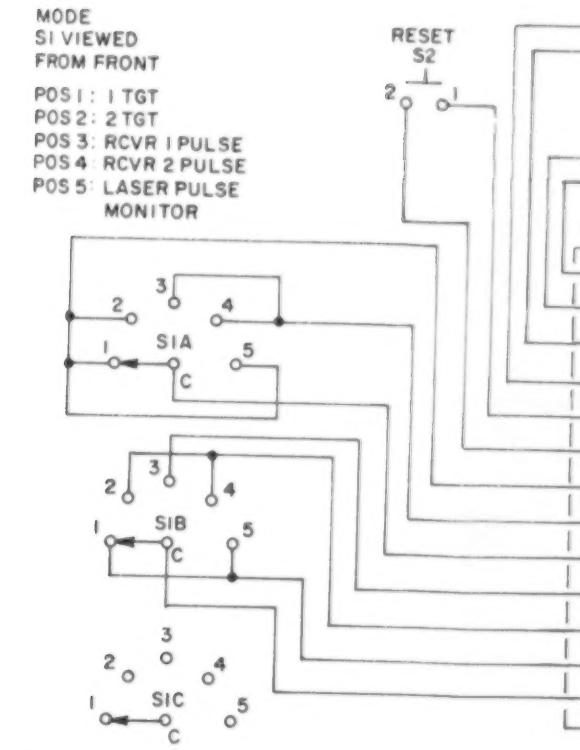


IS OTHERWISE SPECIFIED,
TANCE VALUES ARE IN OHMS,
ITANCE VALUES ARE IN MICROFARADS
AL REFERENCE DESIGNATIONS ARE SHOWN
OMPETE DESIGNATION PREFIX WITH
SSEMBLY DESIGNATION (S)

EL5FA004

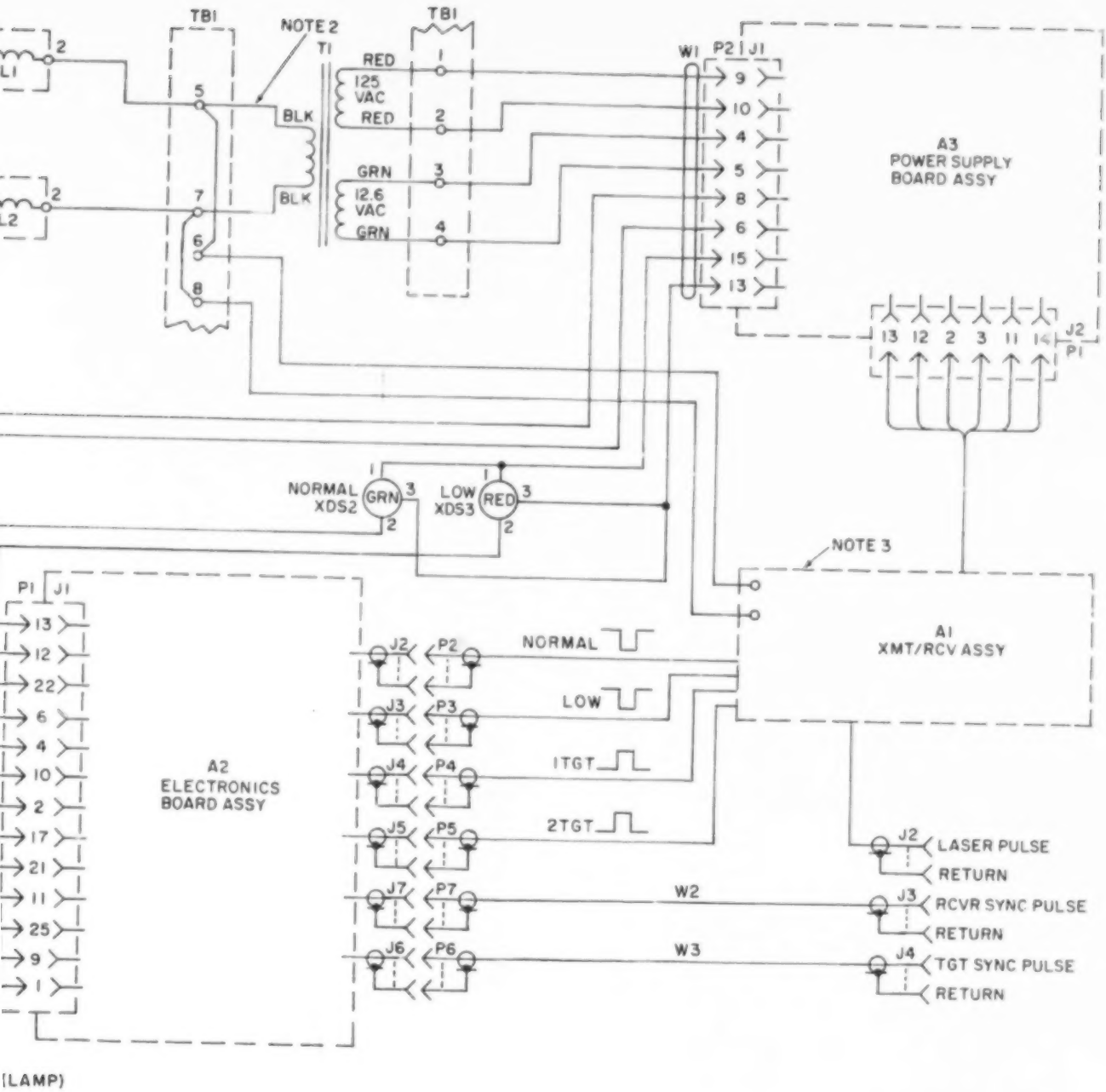
FO-2 Functional Block Diagram





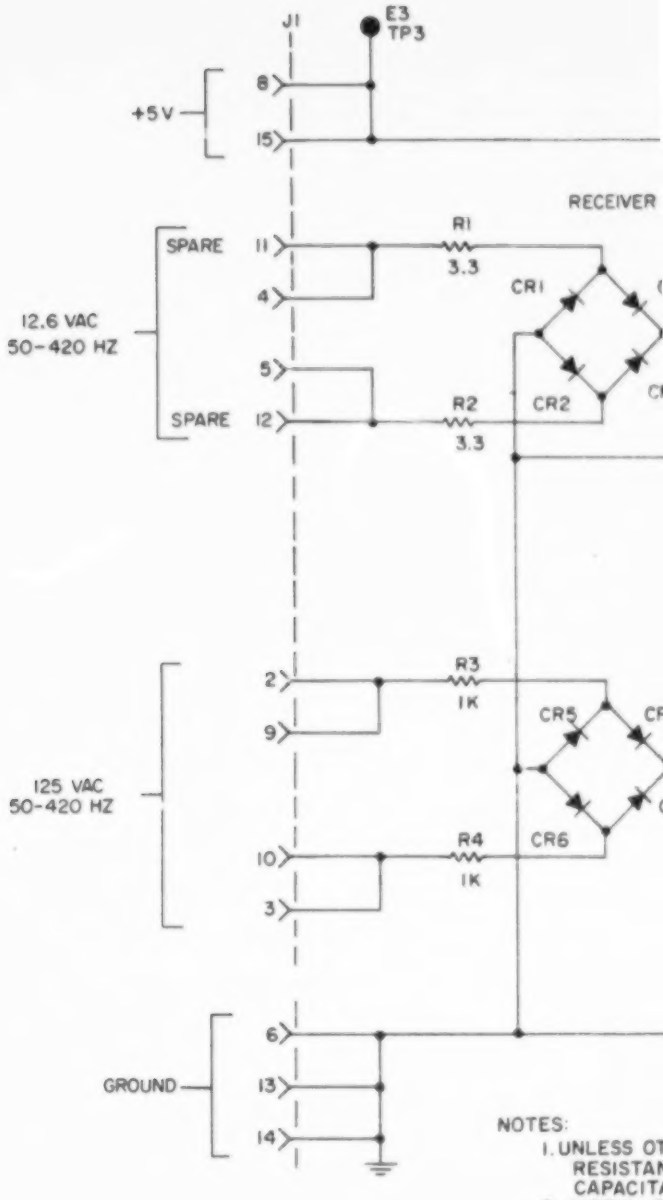
NOTES:

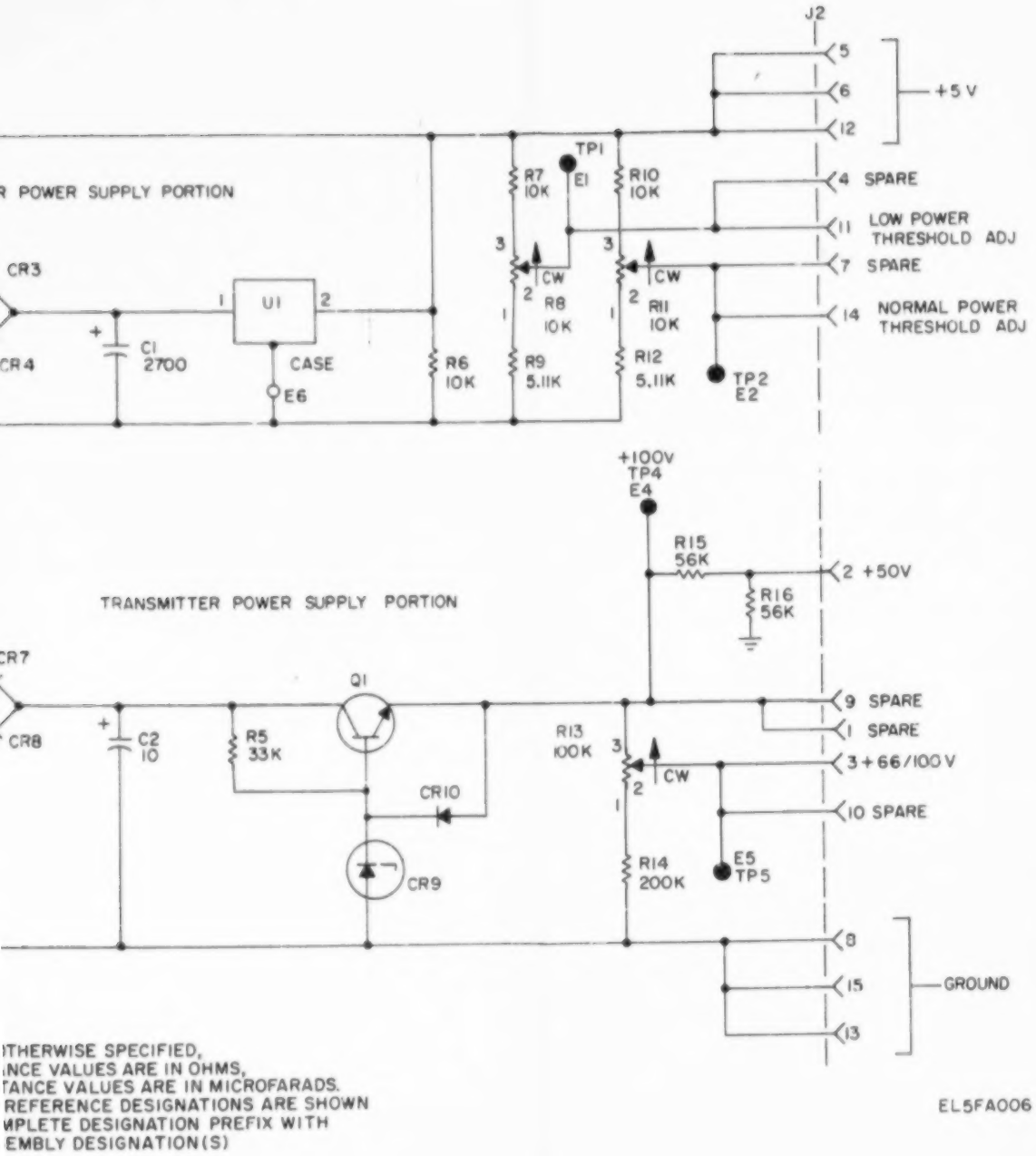
1. XDSI HAS A 62K OHMS RESISTOR IN SERIES WITH DSI (I
   TO CONTACT TERMINAL NO. 1
2. TRANSFORMER T1
   PRIMARY COIL IS 23±15 % OHMS
   SECONDARY 12.6V COIL IS 0.8±15 % OHMS
   SECONDARY 125.0 V COIL IS 87.0±15 % OHMS
3. A1 HEATER ELEMENT GREATER THAN 30K OHMS
4. RESISTANCE VALUES IN OHM ±15 %



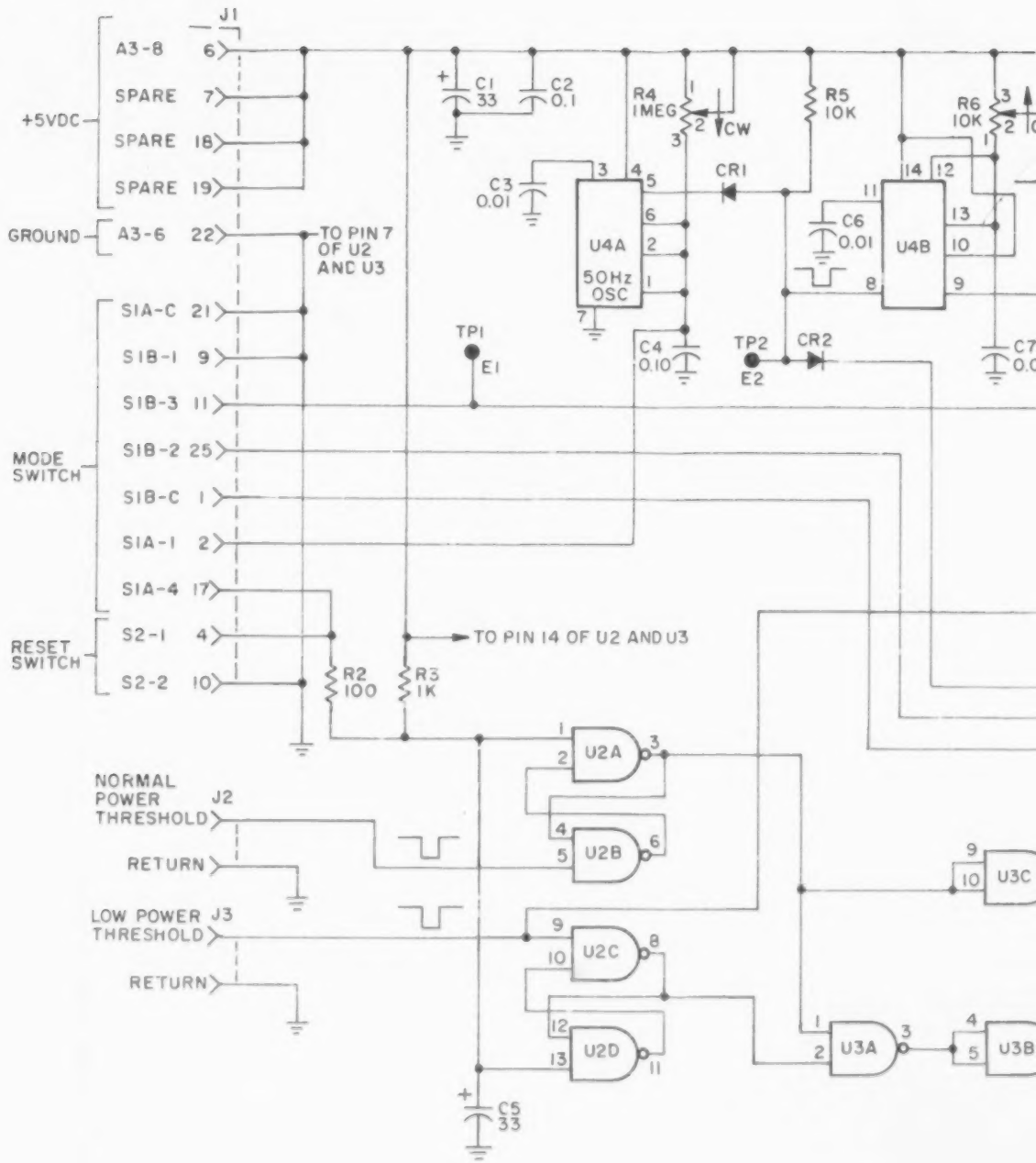
EL5FA005

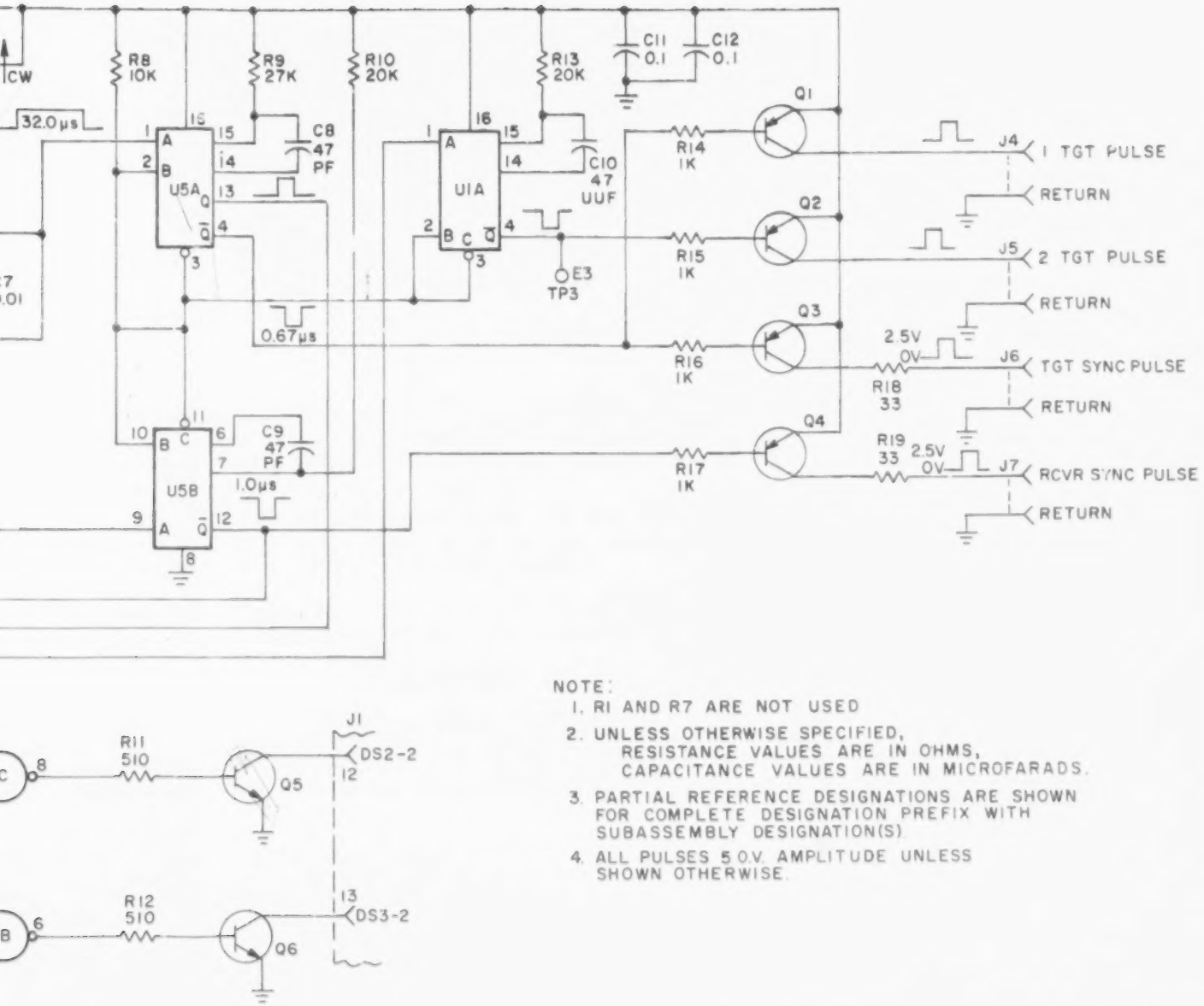
FO-3. LR Tester Schematic Diagram


J1
E3
TP3
+5V
8
15
RECEIVER
SPARE
11
4
12.6 VAC
50-420 HZ
5
SPARE
12
R1
3.3
R2
3.3
CR1
CR2
2
9
125 VAC
50-420 HZ
10
3
R3
1K
R4
1K
CR5
CR6
6
GROUND
13
14
NOTES:
1. UNLESS OT
RESISTAN
CAPACITA
2. PARTIAL R
FOR COM
SUBASSE



FO-4. Power Supply Board Assembly A3 Schematic Diagram


J1
A3-8 6
SPARE 7
SPARE 18
SPARE 19
+5VDC
GROUND
A3-6 22
TO PIN 7 OF U2 AND U3
SIA-C 21
SIB-1 9
SIB-3 11
SIB-2 25
SIB-C 1
SIA-1 2
SIA-4 17
MODE SWITCH
S2-1 4
S2-2 10
RESET SWITCH
TO PIN 14 OF U2 AND U3
C1 33
C2 0.1
C3 0.01
C4 0.10
C5 33
C6 0.01
C7
R1 IMEG
CW
R2 100
R3 1K
R4 IMEG
R5 10K
R6 10K
CR1
CR2
TP1
E1
TP2
E2
U4A
50Hz OSC
U4B
U2A
U2B
U2C
U2D
U3A
U3B
U3C
NORMAL POWER THRESHOLD
J2
RETURN
LOW POWER THRESHOLD
J3
RETURN



NOTE:

1. R1 AND R7 ARE NOT USED
2. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH SUBASSEMBLY DESIGNATION(S).
4. ALL PULSES 5.0 V. AMPLITUDE UNLESS SHOWN OTHERWISE.

EL5FA007

FO-5. Electronics Board Assembly A2 Schematic Diagram

This test equipment is used to test a rangefinder containing a pulsed (Q-switched) Neodymium YAG laser transmitter. Severe eye damage may result if the rangefinder is fired in an unauthorized area, at flat glass, or mirror-like surfaces unless proper eye protection is provided.

Any personnel without proper eye protection who may have been in the vicinity of a laser firing must obtain an eye examination by an ophthalmologist to be sure no eye damage has been done.

Eye protection: Goggles, safety, laser (NSN 4240-00-258-2054). Medical surveillance is required for maintenance personnel as stated in AR 40-46.

WARNING

HIGH VOLTAGE is used in the operation of this equipment. DEATH ON CONTACT may result if personnel fail to observe safety precautions. Learn the areas containing high voltage in this equipment. Be careful not to contact high voltage connections when operating this equipment.

PIN : 043258-000